Watershed Management Plan for the Quilcene-Snow Water Resource Inventory Area (WRIA 17)

Adopted by the WRIA 17 Planning Unit

October 28, 2003

CASCADIA
CONSULTING GROUP

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WRIA 17 Planning Unit Members

Chimacum Grange
City of Port Townsend
Department of Ecology
Home Builders Association
Jefferson County
Jefferson County Conservation District
Marrowstone Island Groundwater Committee
Olympic Environmental Council
Port Gamble S'Klallam Tribe
Port of Port Townsend
Port Townsend Paper Mill
PUD #1 of Jefferson County
Skokomish Tribe
Sustainable Agriculture
Trout Unlimited
Water Utility Coordinating Committee
Wild Olympic Salmon
WSU Cooperative Extension, *ex officio*

The WRIA 17 Watershed Management Plan was written by Cascadia Consulting Group, under contract to the Jefferson County Natural Resources Division.

The Project Manager and Facilitator for the WRIA 17 Planning Unit is Susan Gulick of Sound Resolutions.

The Final Watershed Management Plan was printed in January 2004. This Plan is printed on recycled paper.

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Executive Summary

OVERVIEW

Water Resource Inventory Area (WRIA) 17 is located on the northeastern Olympic Peninsula, and includes portions of Jefferson and Clallam Counties (Figure ES-1). The WRIA encompasses direct drainages to Puget Sound from Jimmycomelately Creek in the northwest to the Big Quilcene River in the south. The watershed also boasts portions of Hood Canal and the Strait of Juan de Fuca, and the northeast flank of the Olympic Mountains.

The Washington State Legislature passed the Watershed Management Act (Chapter 90.82 RCW) in 1998. The purpose of the Watershed Management Act is to provide a framework for addressing water quality, water quantity, and salmon habitat issues at the local level. The Act provides grant funding to Planning Units, which include governmental and non-governmental entities. The ultimate result is a plan for future water resource management.

The WRIA 17 Planning Unit adopted the following purpose statement for the WRIA 17 Watershed Management Plan:

> The purpose of the watershed plan is to create a decision-making tool for water resource management, including future appropriation of water and land use and development decisions. It is the intent of the plan to recommend actions to ensure clean water in sufficient quantities to provide both adequate habitat for fish and an adequate supply for human uses. Therefore the plan will include provisions for water quality protection and enhancement, water conservation, and habitat protection/restoration.

AREAS OF CONCERN

To achieve this goal, the Planning Unit commissioned the development of the WRIA 17 Level 1 Technical Assessment, completed by Parametrix, Inc., in 2000. This document summarizes existing scientific information about water quantity, water quality, habitat, and instream flows in the watershed. It provides a firm scientific foundation for watershed planning, and identifies the following issues of concern:

- In the lower reaches of the Chimacum sub-basin, surface water quality is degraded, and use of both surface and ground water is relatively high. Surface water quality is most degraded in the middle reaches of the creek (Christensen, 2003). Hydraulic continuity is rated high to moderate-high for much of the basin, and habitat along both forks of Chimacum Creek has been degraded. By 2016, an additional 1,570 new residents are anticipated to live in the sub-basin, an increase of 30 percent.
- The Little Quilcene River faces habitat, water quality, water quantity (Jablonski, 2003) and hydraulic continuity issues along much of its length. Near Lake Leland, surface water use from Leland Creek is relatively high. Future growth in this sub-basin is expected to be relatively small.
- The lower reaches of the Big Quilcene River have experienced high greater habitat degradation than the upper reaches. Water use in the lower watershed, coupled with hydraulic continuity, may exacerbate these habitat issues.
- Habitat in the Salmon-Snow Creek sub-basin has been altered including relocation (now largely restored), and the sub-basin has higher hydraulic continuity potential. In the lower Salmon and Snow Creeks, surface water rights are relatively high, and could affect seasonal low stream baseflows. By 2016, approximately 400 new residents will live in the sub-basin, an increase of 30 percent.

- In the Ludlow sub-basin, habitat in Shine Creek has been degraded, while the area adjacent to Ludlow Creek is the focus of relatively high groundwater use and surface water rights near Port Ludlow. Coupled with Ludlow Creek's high hydraulic continuity potential, this water use could affect stream baseflows. By 2016, population in this sub-basin may more than double.
- In the Dabob-Thorndyke sub-basin, Tarboo Creek has surface water quality and habitat issues, along with high hydraulic continuity. Existing land uses in the sub-basin have degraded stream health (Parametrix et al., 2000).

Figure ES-2, drawn from the Technical Assessment, illustrates these issues of concern.

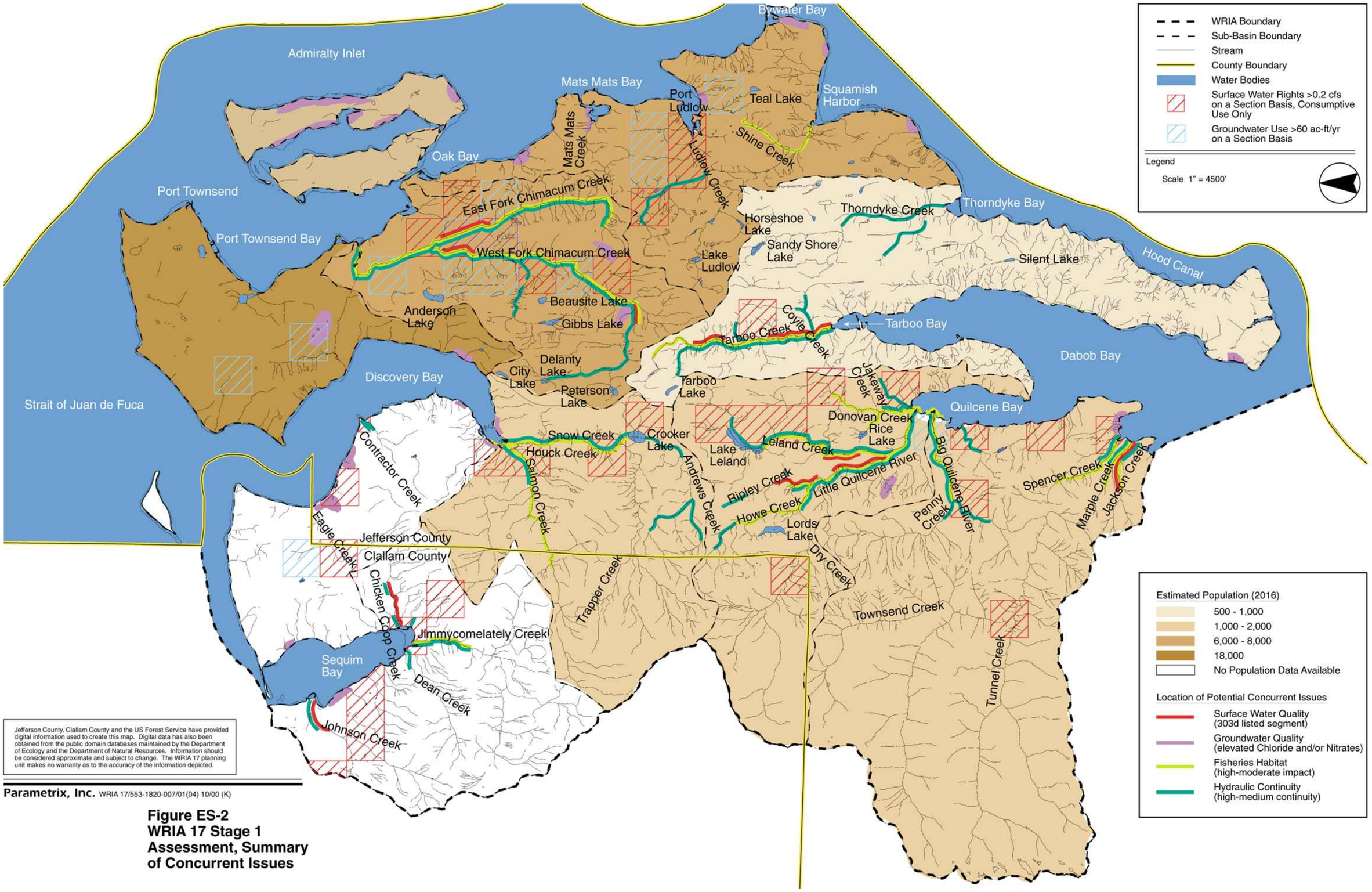
The WRIA 17 Planning Unit identified a wide variety of options to address these challenges. After reviewing these options, the Planning Unit developed its final recommendations by consensus. These recommendations can be found in Chapter 5 of the Watershed Management Plan.

Miller
Quimper
Admiralty Inlet
Indian-Marrowstone
Sequim Bay
Jefferson Creek
Eagle Creek
Contractor Creek
Discovery Bay
Port Townsend Bay
Anderson Lake
Dean Creek
Jimmycomelately Creek
West Sequim Bay
Salmon Creek
Snow Creek
Clallam County
Jefferson County
Oak Bay
Beaver Lake
Deberry Lake
Gibbs Lake
W Fork Chimacum Creek
E Fork Chimacum Creek
Mats Mats Bay
Salmon-Snow
Peterson Lake
Crocker Lake
Chimacum
Port Ludlow Bay
Lake Ludlow
Ludlow Creek
Ludlow
Lords Lake
Lake Leland
Little Quilcene
Dabob-Thorndkye
Beaver Creek
Teal Lake
Bywater Bay
Squamish Harbor
Townsend Creek
Donovan Creek
Thorndyke Creek
Farbon Bay
Big Quilcene
Tunnel Creek
Quilcene Bay
Thorndyke Bay
Dabob Bay
Hood Canal

FIGURE ES-1 WRIA 17 PROJECT AREA AND SUBBASINS

WRIA 17 Boundary
Sub-basin Boundary
County Boundary
Streams
Water Bodies

0 10000 Feet



Jefferson County, Clallam County and the US Forest Service have provided digital information used to create this map. Digital data has also been obtained from the public domain databases maintained by the Department of Ecology and the Department of Natural Resources. Information should be considered approximate and subject to change. The WRIA 17 planning unit makes no warranty as to the accuracy of the information depicted.

Parametrix, Inc. WRIA 17/553-1820-007/01(04) 10/00 (K)

Figure ES-2
WRIA 17 Stage 1 Assessment, Summary of Concurrent Issues

Summary of Recommended Actions

WATER QUANTITY RECOMMENDATIONS

1. Prepare and implement water conservation plans
2. Increase public awareness and education on water use
3. Coordinate regional drought contingency and system security planning
4. Participate in water rights acquisition programs
5. Protect critical aquifer recharge areas and wellhead protection zones
6. Better implement water-metering and reporting requirements in the WRIA
7. Facilitate compliance with existing laws and regulations regarding illegal water withdrawals
8. Identify where existing laws constrain wise water use and promote changes to these laws

WATER QUALITY RECOMMENDATIONS

9. Continue Conservation District program with landowners
10. Protect and restore riparian vegetation
11. Reduce pesticide and herbicide use
12. Reduce use and release of synthetic organic compounds
13. Implement a surface and ground water quality monitoring plan
14. Encourage water quality monitoring
15. Work with state agencies to upgrade water quality data accessibility
16. Adopt surface water and/or stormwater management plans
17. Adopt stormwater management manual
18. Provide public education for water quality
19. Compile and track public outreach and education programs

HABITAT RECOMMENDATIONS

20. Support the Hood Canal Coordinating Council's salmon habitat restoration efforts
21. Utilize the Limiting Factors Analysis and Refugia Study to guide habitat restoration activities
22. Support local salmon recovery efforts
23. Advocate for changes to the Conservation Reserve Enhancement Program (CREP)
24. Conserve instream wood, formalize large wood stockpiling efforts, and collaborate on education
25. Update and revise maps of sensitive areas
26. Adopt and implement a stormwater management manual
27. Adopt countywide road maintenance standards
28. Continue to enforce Jefferson County development regulations
29. Transfer regulatory authority over Class IV general forest practices to local governments
30. Secure a permanent, stable revenue source to maintain adequate fish passage
31. Expand citizen-based salmon habitat programs
32. Support the Washington Water Acquisition Program
33. Investigate a transfer of development rights program (TDR)
34. Provide public education about the value of healthy habitats and the importance of habitat restoration efforts
35. Compile and track public outreach and education programs

INSTREAM FLOW RECOMMENDATIONS

36. Adopt instream flows

OVERARCHING RECOMMENDATIONS

37. Pursue other funding and revenue options
38. Coordinate planning across numerous agencies
39. Improve the sharing of existing information and data gathering
40. Update critical areas ordinance and shoreline master program
41. Adjust boundary line between WRIA 17 and WRIA 18
42. Improve communication with the public
43. Amend or update Watershed Plan

Chapter 1: Introduction and Background

1.1 Watershed Planning in WRIA 17

This section presents an introduction to the history of watershed planning in WRIA 17 and related planning efforts.

1.1.1 History of Watershed Planning in WRIA 17

In 1991, the Washington State Department of Ecology selected the Dungeness-Quilcene watershed as a pilot area to test the feasibility of local watershed planning. The Dungeness-Quilcene Plan, developed between 1991 and 1994, was the result of this pilot project. The plan, also known as the D-Q Plan, contains recommendations for water conservation, public education, protection of fish stocks and habitat, restoration of instream flows, protection and restoration of water quality, and provision of water for growth (WRIA 17 Planning Unit, 2003).

The Dungeness-Quilcene Plan was in place by the time the Washington State Legislature passed HB2514, the Watershed Management Act of 1998. The purpose of the Watershed Management Act is to provide a framework for addressing water quality, water quantity, and salmon habitat issues at the local level. The Act provides grant funding to Planning Units, which are councils of governmental and non-governmental entities, to perform two tasks (WRIA 17 Planning Unit, 2003):

- Determine the status of water resources in a watershed; and
- Resolve the often-conflicting demands for that water, including ensuring that enough water is available for salmon.

The ultimate result of these efforts is a plan for future water resource management. Each Planning Unit is responsible for a specific geographic area, called a Water Resource Inventory Area, or WRIA. The WRIA boundaries are established in the state's administrative code (Ch. 173-500). WRIA 17 encompasses direct drainages to Puget Sound on the northeast corner of the Olympic Peninsula, from Jimmycomelately Creek in the northwest to the Quilcene River in the south.

Did You Know?

- WRIA 17 is one of the Washington State Department of Ecology's 16 priority basins for watershed planning.
- Governments, businesses, and citizen groups have been working together on watershed planning in WRIA 17 since 1991.

1.1.2 THE WRIA 17 PLANNING UNIT

The goal of the WRIA 17 Planning Unit is to create a watershed plan that addresses water quantity, water quality, instream flows, and habitat, using the Dungeness-Quilcene Plan and the Level 1 Technical Assessment as a foundation. Currently, the WRIA 17 Planning Unit counts the following entities as members:

- Chimacum Grange
- City of Port Townsend
- Department of Ecology
- Home Builders Association
- Jefferson County
- Jefferson County Conservation District
- Marrowstone Island Groundwater Committee
- Olympic Environmental Council
- Port Gamble S'Klallam Tribe
- Port of Port Townsend
- Port Townsend Paper Mill
- PUD #1 of Jefferson County
- Skokomish Tribe
- Sustainable Agriculture
- Trout Unlimited
- Water Utility Coordinating Council
- Wild Olympic Salmon
- WSU Cooperative Extension (ex officio)

The Planning Unit also created a Steering Committee to assist with administrative matters, set goals and priorities, and make recommendations to the Planning Unit. Representatives of Tribal Government, Jefferson County Government, the Water Resources Council, Jefferson County PUD #1, City of Port Townsend, and the Department of Ecology serve on this committee. The WRIA 17 Technical Committee includes representatives of the Jefferson County Conservation District, Jefferson County PUD #1, the Washington Department of Fish and Wildlife, the City of Port Townsend, the Port Townsend Paper Company, the Port Gamble S'Klallam Tribe, the Port Townsend Water Department, Jefferson County, Wild Olympic Salmon, Washington State University, Trout Unlimited, the Washington Department of Ecology, the US Fish and Wildlife Service, and citizens. The WRIA 17 Planning Unit has been working together since 1999 (WRIA 17 Planning Unit, 2003).

Achievements

To support development of the watershed plan, the Planning Unit commissioned a Stage 1 Technical Assessment of the watershed using grant funding from the Department of Ecology. This Technical Assessment, completed in 2000, summarizes existing scientific information about the watershed, focusing on the four topics of interest to the Planning Unit – water quantity, instream flows, water quality, and habitat.

The Stage 1 Technical Assessment identified a need for additional information about groundwater resources and the interactions between groundwater and surface water in the Big Quilcene, Little Quilcene, and Chimacum Creek sub-basins of WRIA 17. Therefore, the WRIA 17 Planning Unit reached an agreement with the US Geological Survey to study the groundwater-surface water interactions in the Chimacum Creek sub-basin and in the Quilcene Bay area, and to define the groundwater resources in the Chimacum Creek sub-basin. Jefferson County entered into a cost-sharing agreement with the US Geological Survey to conduct this study for the WRIA 17 Planning Unit.

Sequim Bay Watershed Agreement

Clallam County, the lead agency for WRIA 18, has been conducting watershed planning in the Sequim Bay basin since 1991 under the auspices of the Dungeness - Quilcene Pilot Planning Project. The

planning effort has evolved under the RCW 90.82 Watershed Planning Act under the Dungeness River Management Team. However, the Sequim Bay sub-basin is part of WRIA 17. In order to maintain the continuity of this planning process, the WRIA 17 Planning Unit signed an agreement with the WRIA 18 Initiating Governments in 2001 that grants planning responsibilities for this sub-basin to WRIA 18. As a result, the WRIA 18 Initiating Governments developed the recommendations for water quality, water quantity, instream flows, and habitat restoration and protection that are presented in the WRIA 17 watershed plan for this sub-basin. Appendix 2 contains the section of the WRIA 18 plan that addresses the Sequim Bay Sub-basin in its entirety.

1.1.3 RELATED PLANNING EFFORTS

The WRIA 17 Planning Unit's watershed plan includes recommendations for protecting and restoring salmon habitat, as well as ensuring that adequate water remains in streams and rivers to support salmon runs. In addition to the WRIA 17 Planning Unit, at least two groups are addressing salmon habitat in this area (WRIA 17 Planning Unit, 2003):

- The Hood Canal Coordinating Council; and
- The North Olympic Peninsula Salmon Restoration Lead Entity.

These groups' efforts are described below.

What is the Salmon Recovery Act?

The Salmon Recovery Act established the Salmon Recovery Funding Board as a mechanism for distributing federal, state, and other funding for salmon habitat projects. Under this Act, affected counties, cities, and tribal governments jointly agreed to support the Hood Canal Coordinating Council as the Lead Entity for the Hood Canal watershed.

HOOD CANAL COORDINATING COUNCIL

The Hood Canal Coordinating Council (HCCC) was established in 1985 in response to concerns about water quality and associated environmental issues. The HCCC, whose members include Jefferson, Mason, and Kitsap Counties and the Skokomish and Port Gamble S'Klallam Tribes, added preservation of salmon runs to its mission statement in 1996. The Hood Canal Coordinating Council also serves as the Lead Entity for the Hood Canal watershed under the Salmon Recovery Act (ESHB 2496), and recommends salmon habitat projects to the Salmon Recovery Funding Board (Hood Canal Coordinating Council, 2003). The HCCC, funded by the State of Washington's Salmon Recovery Planning Grant program, is also responsible for the development of a salmon recovery plan for Hood Canal summer chum salmon listed as threatened under the Endangered Species Act (ESA). As Lead Entity, the HCCC solicits salmon recovery projects from counties, cities, conservation districts, tribes, environmental groups, business interests, landowners, citizens, volunteer groups, regional fish enhancement groups, and other habitat interests. It is also being used to facilitate the ranking of those projects into an overall, prioritized list, which is then submitted to the State Salmon Recovery Funding Board for funding.

THE NORTH OLYMPIC PENINSULA SALMON RESTORATION LEAD ENTITY

The goal of this group is to provide a coordinated strategy for salmon recovery in the North Olympic Peninsula. Like the Hood Canal Coordinating Council, the group recommends projects to the Salmon Recovery Funding Board (WRIA 17 Planning Unit, 2003).

1.2 Overview of WRIA 17

This section provides an introduction to the Quilcene-Snow Watershed, also known as WRIA 17. Information in this section is drawn from the Level 1 Technical Assessment (Parametrix et al., 2000).

1.2.1 WRIA 17

WRIA 17 is located on the northeastern Olympic Peninsula, and includes portions of Jefferson and Clallam Counties. The WRIA encompasses direct drainages to Puget Sound from Jimmycomelately Creek in the northwest to the Quilcene River in the south. The watershed also boasts portions of the Hood Canal and the Strait of Juan de Fuca, and the northeast flank of the Olympic Mountains.

Approximately 26,835 people live in WRIA 17, many of them in Port Townsend, the main population center of the watershed. More than seventy percent of the 256,783 acres in the WRIA are privately owned; the federal government owns twenty percent and state government owns the remaining ten percent.

Glaciers were the primary shapers of WRIA 17. The terrain ranges from the steep slopes of the Olympic Mountains to coastal lowlands drained by high gradient streams. Deep to moderately deep loams and areas of silt and clay are characteristic of soils in WRIA 17. In lowland valleys, pasture vegetation is common, while at higher elevations alders and conifers predominate (Parametrix et al., 2000).

1.2.2 WRIA 17 Sub-basins

WRIA 17 contains 10 sub-basins:

- Indian-Marrowstone
- Quimper
- Chimacum
- Ludlow
- Dabob-Thorndyke
- Miller
- West Sequim Bay
- Salmon-Snow
- Little Quilcene
- Big Quilcene

This section provides brief descriptions of each sub-basin, based upon information from the Stage 1 Technical Assessment (Parametrix et al., 2000). Each of these sub-basins has unique water resource advantages and issues. The main body of this report organizes information about water quantity, water quality, instream flows, and habitat by sub-basin so that stakeholders who are concerned with a particular geographic area can find information quickly.

INDIAN-MARROWSTONE SUB-BASIN

This sub-basin encompasses two islands, Indian and Marrowstone, located between Port Townsend Bay and Admiralty Inlet. The sub-basin does not have any significant surface water features. The residents of Marrowstone Island draw their water from aquifers in glacial and bedrock formations. The US Navy installation on Indian Island obtains its water from the Jefferson County Public Utilities District's Tri-Area water system.

QUIMPER SUB-BASIN

This sub-basin is located on the Quimper Peninsula in the northeast portion of WRIA 17. Like the Indian-Marrowstone Sub-basin, the Quimper Sub-basin does not have significant streams – rather, the streams are intermittent and tend to have steep gradients. When flowing, these streams drain to Port Townsend Bay, Discovery Bay, Admiralty Inlet, Puget Sound and the Strait of Juan de Fuca. The City of Port Townsend and Cape George are the two population centers of this sub-basin.

CHIMACUM SUB-BASIN

The Chimacum Sub-basin is south of the Quimper Sub-basin, and a series of lowland hills forms its southern end. Chimacum Creek is the heart of this sub-basin. Delanty Lake, Gibbs Lake, Beausite Lake and Anderson Lake are also in this sub-basin.

LUDLOW SUB-BASIN

The Ludlow Sub-basin occupies much of the eastern end of WRIA 17. It draws its name from Ludlow Creek, but Shine Creek, Mats Mats Creek, Ludlow Lake, Horseshoe Lake, and Teal Lake are also located here. Significant portions of the sub-basin drain to Oak Bay, Mats Mats Bay, and Squamish Harbor.

DABOB-THORNDYKE SUB-BASIN

This sub-basin, located on the Bolton and Toandos Peninsulas in southeastern WRIA 17, takes its name from Dabob Bay and Thorndyke Creek. Beside Thorndyke Creek, the only other significant stream is Tarboo Creek; most of the other 30-plus streams in the sub-basin are less than a mile long. Thorndyke Creek's headwaters are in Sandy Shore Lake.

MILLER SUB-BASIN

This sub-basin occupies a peninsula between Discovery Bay and Sequim Bay. Most of this sub-basin drains directly to the two bays through small, unnamed streams. Eagle Creek and Contractors Creek are the two primary freshwater features of this sub-basin.

WEST SEQUIM BAY SUB-BASIN

Four significant streams drain this northern sub-basin: Jimmycomelately Creek, Chicken Coop Creek, Dean Creek, and Johnson Creek. All four streams discharge to Sequim Bay. A variety of smaller, unnamed streams also drain to Sequim Bay from this sub-basin. Under the agreement mentioned above in section 1.1.2, WRIA 18 is responsible for watershed planning for this sub-basin.

SALMON-SNOW SUB-BASIN

This sub-basin takes its name from Salmon and Snow Creeks, its two major water features, both of which begin in the Olympic Mountains foothills and drain to Discovery Bay. Trapper Creek and Andrews Creek are tributaries to Snow Creek.

LITTLE QUILCENE SUB-BASIN

The Little Quilcene River, the major surface water feature of this sub-basin, begins in the Olympic National Forest and discharges to Quilcene Bay, about one mile north of the mouth of the Big Quilcene River. Donovan Creek and Jakeway Creek also drain directly to Quilcene Bay, and Lake Leland, the largest of the four lakes in the sub-basin, feeds Leland Creek, which is tributary to the Little Quilcene River.

BIG QUILCENE SUB-BASIN

This sub-basin at the southern end of WRIA 17 contains the Big Quilcene River and is primarily in federal ownership. Penny Creek, Townsend Creek, and Tunnel Creek are the largest tributaries to the Big Quilcene River, and Spencer, Marple, and Jackson Creeks drain directly to Quilcene Bay.

1.2.3 LAND USE PATTERNS

This section presents an overview of land use in WRIA 17, summarized from the Stage 1 Technical Assessment (Parametrix et al., 2000). The WRIA 17 Stage 1 Technical Assessment provides a more in-depth analysis of land use patterns; the interested reader is directed there for further information.

Nearly forty percent of the 256,783 acres in WRIA 17 is devoted to forestry, including national forests, commercial forest, and inholdings. The Big Quilcene, Salmon-Snow, and Dabob-Thorndyke Sub-basins have large forested areas. Rural residential is the second-largest land use in WRIA 17, with nearly 70,000 acres. Agricultural lands occupy over 4,000 acres, many of which are in the Chimacum Sub-basin. Perhaps not surprisingly, the majority of the WRIA's commercial and industrial lands are in the Quimper Sub-basin, where Port Townsend is located. The US Navy has an installation on Indian Island, part of the Indian-Marrowstone Sub-basin.

The population of WRIA 17 has been projected to increase fifty-five percent between 1996 and 2016, from about 24,000 to 38,000, based on estimates developed for the Jefferson County Comprehensive Plan in 1996 (Parametrix et al., 2000). Recently, these projections were updated with information from the 2000 Census, and show 2015 populations from 29,935 in the low growth scenario to 38,197 under the high growth scenario (Office of Financial Management, 2003). Much of this increase is expected to occur in the Quimper Sub-basin, which includes Port Townsend, and the Ludlow Sub-basin, which includes Port Ludlow (Parametrix et al., 2000). Growth is also expected in the Chimacum sub-basin (Jefferson County PUD, 2003).

1.2.4 WEATHER PATTERNS

WRIA 17 is located in the rain shadow of the Olympic Mountains. Like other watersheds in Western Washington, WRIA 17 experiences a wet season and a dry season annually. Generally, the wet season begins in November and ends in May, and over seventy percent of the annual precipitation falls during this period.

Precipitation data have been collected in WRIA 17 since the 1940s. According to an analysis of these data conducted by Parametrix et al. (2000) for the Stage 1 Technical Assessment, WRIA 17 has experienced a period of above average precipitation since 1994. Between 1985 and 1994, precipitation was below average.

Within WRIA 17, amounts of annual precipitation increase to the south and west. The Quimper Sub-basin on the eastern edge of the watershed receives 15-20 inches of rainfall annually, while the foothills of the Olympic Mountains in the western side of the watershed receive 70-80 inches annually. Precipitation also tends to increase as elevation increases, although only one gauge exists at high elevations in WRIA 17.

Understanding the geographic distribution of precipitation is critical to grasping the potential for groundwater recharge and runoff in different parts of the WRIA, because both increase as precipitation increases. For more detail on precipitation, please refer to the Stage 1 Technical Assessment (Parametrix et al., 2000).

1.3 Document Map

The remainder of this document consists of four chapters.

- **Chapter 2, Purpose Statement** – presents the purpose of this Watershed Plan.
- **Chapter 3, Watershed Analysis** – summarizes information about water quantity, instream flows, water quality, and habitat for each of the ten sub-basins in the WRIA.
- **Chapter 4, Options** – analyzes options for protecting and improving water quantity, water quality, and habitat in WRIA 17.
- **Chapter 5, Recommendations** – presents the WRIA 17 Planning Unit's recommended action plan.

Following the body of the main plan, three appendices present additional information.

- **Appendix 1, Watershed Plan Implementation** – outlines the existing regulatory framework and current activities of Planning Unit members that relate to plan implementation; it also includes a table summarizing the recommendations and expected implementers.
- **Appendix 2, Climate Variability, Climate Change, and Watershed Planning** – presents information from the University of Washington on how climate change may affect watershed planning in the Pacific Northwest.
- **Appendix 3, Sequim Bay Section of the Draft WRIA 18 Watershed Plan** – excerpts a portion of the Draft WRIA 18 Watershed Plan pertaining to the Sequim Bay watershed.

Chapter 2: Purpose Statement

2.1 WRIA 17 Watershed Plan Purpose Statement

The purpose of the watershed plan is to create a decision-making tool for water resource management, including future appropriation of water and land use and development decisions. It is the intent of the plan to recommend actions to ensure clean water in sufficient quantities to provide both adequate habitat for fish and an adequate supply for human uses. Therefore the plan will include provisions for water quality protection and enhancement, water conservation, and habitat protection/restoration.

Chapter 3: Watershed Analysis

Watershed Analysis

This chapter summarizes scientific information about instream flows, water quantity, water quality, and habitat in WRIA 17. Except for the Instream Flows section, each section of this chapter begins with an overview of WRIA-wide conditions, followed by a discussion of conditions in each sub-basin. The Instream Flows section summarizes information on instream flows in WRIA 17, and describes the process that the WRIA 17 Planning Unit will use to determine recommended instream flows and achieve consensus on those recommendations.

Except where otherwise noted, the information about instream flows, water quantity and water quality is drawn from the WRIA 17 Technical Assessment. Information about habitat quality is taken from the WRIA 17 Limiting Factors Assessment. The interested reader is directed to these two resources for additional information.

3.1 Instream Flows

Instream flows are the amount of water flowing in a river channel that is considered adequate to meet the management objectives for a river. Usually, instream flows are stated as minimum flows, so that instream flows are met if the rate of water flowing in a stream meets or exceeds the instream flow level. Once an optimum instream flow is identified for a basin, planners can estimate the amount of "extra" water that can be allocated for diversion or other uses (Rushton, 2000).

In order to set instream flows, management objectives must first be identified for a stream or river. These management objectives usually include ensuring that adequate habitat exists for salmon species at a variety of life stages such as spawning, rearing, transition to and from salt water, and migration. In other words, the instream flow level depends in part upon the management objectives for a river. If the management objective for a river were to provide as much drinking water as possible, it likely would have a different instream flow than if the management objective were to provide outstanding spawning habitat for threatened chinook salmon (Rushton, 2000).

Instream flows can be codified into a state rule. Once they are set by rule, they become a water right and condition any water right applications made thereafter. However, they have no effect on water rights that existed before the instream flow was set by rule (Rushton, 2000).

3.1.1 Summary of Instream Flow Information

Investigators have conducted several instream flow studies in WRIA 17. The Washington Departments of Ecology and Fish and Wildlife performed toe-width studies on many streams in 1997 and 1999, and Ecology conducted an Instream Flow Incremental Method (IFIM) study on the Big Quilcene River in 1999.

Toe-width studies measure the width of a stream or river at the toe, or base, of its banks. Using these measurements together with the known habitat requirements of the species of interest, scientists can develop optimum instream flow hydrologies. This methodology often is used because it is relatively inexpensive. However, it generates only one theoretical instream flow value per species lifestage, leaving little room for flexibility. The WRIA 17 Technical Assessment contains a table of data (Table 6-1) from toe-width studies on the following streams and rivers in WRIA 17:

- Chicken Coop Creek
- Chimacum Creek
- Dean Creek
- Donovan Creek
- Howe Creek
- Jimmycomelately Creek
- Johnson Creek
- Leland Creek
- Little Quilcene River
- Ludlow Creek
- Marple Creek
- Ripley Creek
- Spencer Creek
- Tarboo Creek
- Thorndyke Creek
- Unnamed Mats Mats Bay tributary

As mentioned above, the Department of Ecology also undertook an IFIM study of the Big Quilcene River in 1999. IFIM is "a process for solving water resource allocation problems that include riverine habitat resources" (Bovee et al., 1998). This methodology, which is more complex than the toe-width method, relies on a series of computer models to predict a range of flows to protect habitat resources. Because the method generates a series of possible flows, it allows resource managers and other stakeholders to compare the benefits of the different water management alternatives and select one that best meets the management objectives for the stream or river. Other methodologies, such as the incremental wetted-perimeter method, also provide a range of flows and management options (Jefferson County PUD, 2003). However, the Department of Ecology recommends the use of IFIM for setting instream flows. Table 6-2 of the WRIA 17 Technical Assessment displays the results of the IFIM study for the Big Quilcene River.

In addition to these recent instream flow studies, the US Department of Fish and Wildlife conducted some instream flow studies in 1993. Table 6-3 of the WRIA 17 Technical Assessment contains the resulting data for the following streams in WRIA 17:

- Big Quilcene River
- Chevy Chase Creek
- Chicken Coop Creek
- Mainstem Chimacum Creek
- East Fork Chimacum Creek
- West Fork Chimacum Creek
- Contractors Creek
- Donovan Creek
- Eagle Creek
- Howe Creek
- Johnson Creek
- Little Quilcene River
- Unnamed Donovan Creek tributary
- Penny Creek
- Ripley Creek
- Salmon Creek
- Shine Creek
- Snow Creek
- East Squamish Creek
- Tarboo Creek
- East Fork Tarboo Creek
- Thorndyke Creek
- Jimmycomelately Creek
- Leland Creek
- Ludlow Creek
- Unnamed Mats Mats Bay tributary

- Unnamed East Sequim Bay tributary
- Unnamed Sequim Bay tributary
- Unnamed Straits tributary

Because instream flows have not been set by rule for any of the streams or rivers in WRIA 17, there are no required instream flows in WRIA 17. However, the City of Port Townsend and the Port Townsend Paper Company have managed their withdrawals of surface water from the Big Quilcene River to comply with a voluntary instream flow agreement that set minimum flows at 24 cubic feet per second (cfs) between 1994 and 1997, and 27 cfs from 1997 onward. Between 1994 and 1999, flows in the Big Quilcene River at the diversion have averaged 50 cfs but have been as low as 26 cfs in the summer-chum spawning season. Although these flows comply with the voluntary agreement, they are significantly less than the 180 cfs that the Big Quilcene River IFIM study determined would provide maximum chum spawning habitat.

3.1.2 Process for Recommending Instream Flows

The Watershed Planning Act of 1998 provides authority for Planning Units to recommend instream flows in their watersheds for the Department of Ecology to establish through a formal rule-making process. Planning Units must develop instream flow recommendations by consensus. In this case, the law defines consensus as unanimous approval of the recommended instream flows by all governments and tribes, and a majority of non-governmental members, of a planning unit that are present for a recorded vote. If a Planning Unit attempts to develop instream flow recommendations but is unable to reach consensus, the Watershed Planning Act directs the Department of Ecology to set instream flows in consultation with affected Tribes (Department of Ecology, 2003).

When the Department of Ecology sets instream flows, it invites affected Tribes and other natural resource agencies to participate in the process and to offer recommendations. Using input from these partners and from its own analysis, Ecology then develops a draft instream flow recommendation for public review and comment. Often, Ecology will hold public workshops to encourage public participation in developing the recommendation. Ecology always holds public hearings to gather official public comment. Based on the comments, Ecology may choose to revise the recommendation and resubmit it for comments before adopting a final instream flow level (Smith, 1998).

The WRIA 17 Planning Unit submitted a grant proposal to the Washington State Department of Ecology in December 2002 and was approved for funding to gather additional information on wetted perimeter widths in WRIA 17 streams. The project will improve understanding of flow conditions as they relate to available habitat in many WRIA 17 streams.

3.2 Water Quantity

This section presents an overview of surface and groundwater quantity in WRIA 17, followed by discussions of water quantity in each of the WRIA 17 sub-basins. The information in this section is drawn from the WRIA 17 Technical Assessment (Parametrix et al., 2000) unless otherwise noted.

3.2.1 WATER QUANTITY OVERVIEW

3.2.1.1 Groundwater Quantity

The consultant team that prepared the Stage 1 Assessment of WRIA 17 developed a model of groundwater recharge for the watershed. Groundwater recharge is defined as the amount of water that seeps into the ground, refilling the "groundwater reservoir." It is a more relevant indicator of groundwater quantity than is groundwater storage, because it provides insight into the sustainability of groundwater supply rather than a snapshot estimate of the amount of water in the ground at a given moment in time.

Like all models, the model developed for the Technical Assessment has a number of limitations and used a variety of assumptions; the interested reader is directed to Chapter 4 of the Technical Assessment for more information about these. The model used information about precipitation, surficial geology, and land use to determine annual recharge rates for each sub-basin in the WRIA.

Using this model, the consultant team estimated that groundwater recharge varies across the watershed due largely to variations in surficial geology and precipitation. Where bedrock is near the surface, such as in the Big Quilcene Sub-basin and on Indian Island, groundwater recharge is low, between 0 and 5 inches per year. Where bedrock is not near the surface, recharge increases, but it is limited by the presence of shallow glacial till. This till is not very permeable, restricting groundwater recharge to 10-15 inches per year even in places with high precipitation. For example, the Dabob-Thorndyke Sub-basin receives 39.4 inches of annual precipitation but has a recharge rate of only 14.4 inches per year, largely because glacial till underlies about 70% of the sub-basin.

Small areas of the watershed have recharge rates over 30 inches per year. These are areas with high precipitation and no glacial till or bedrock above the aquifer. They tend to occur in the southern portion of the watershed near lakes and rivers. Exhibit 6 of the Technical Assessment's Appendix provides a map of estimated groundwater recharge in the watershed.

Table 1 summarizes the groundwater recharge information from the Technical Assessment. Additional information about groundwater recharge, including estimates of the amount of each sub-basin covered by bedrock and glacial till, can be found in Table 4-2 of the Technical Assessment.

Table 1: Groundwater Recharge by Sub-basin

Sub-basin	Average Precipitation (inches/year)	Annual Recharge (inches/year)	Annual Recharge (acre-feet/yr)	Recharge as Percent of Precipitation
Big Quilcene	51.9	2.4	10,279	5%
Chimacum	27.2	9.5	18,712	35%
Dabob-Thorndyke	39.3	14.4	39,743	37%
Indian-Marrowstone	22.0	5.5	3,002	25%
Little Quilcene	47.5	6.3	14,652	13%
Ludlow	29.8	10.0	21,237	33%
Miller	25.1	5.8	8,115	23%
Quimper	21.5	5.8	8,980	27%
Salmon-Snow	35.5	4.1	9,461	12%
West Sequim Bay	28.2	3.2	6,478	11%
WRIA 17 Total	**N/A**	**6.6**	**140,659**	**N/A**

The total volume of groundwater recharge in WRIA 17, according to the model, is about 140,000 acre-feet per year. The seasonal variability of groundwater recharge is much less than that of surface water quantity, because aquifers tend to act as reservoirs, holding water even when precipitation is low. However, in the long term, groundwater recharge does vary as a function of precipitation.

3.2.1.2 Groundwater Allocation and Use

The WRIA 17 Technical Assessment estimates the amount of groundwater that has been allocated in water rights and claims, and the amount of groundwater that is used annually in WRIA 17. These estimates are based on a variety of data sources, some of which are of higher quality than others; the interested reader is directed to Chapter 4 of the Technical Assessment for more information on the methods and data quality of these estimates.

The Technical Assessment contains information about water applications, claims, and rights. Applications are requests for new water rights, and water rights are permits to use water. Claims, on the other hand, are more complex. Washington's water-rights system has been in place since 1917 for surface water withdrawals and since 1945 for groundwater withdrawals. However, not all water rights were registered during the water-rights process, so Washington allowed individuals to register withdrawals developed prior to 1917 and 1945 during two "claims periods," one in 1969-1974 and one in 1997-1998. A water-right claim is not a water right, and filing the claim does not grant the claimant a water right.

Rather, a claim is a statement in claim to a water right developed before 1917 or 1945. The Department of Ecology has not yet determined the validity of most claims.

Table 2 summarizes the number of consumptive groundwater applications, claims, and water rights by sub-basin in WRIA 17, and shows the approximate quantities of groundwater that these represent. Consumptive uses of groundwater are those that use water up rather than return it to the ground.

Table 2: Summary of Consumptive Groundwater Rights in WRIA 17

Sub-basin	Applications	Volume (GPM[1])	Rights and Claims (count)	Volume (AF[2])
Big Quilcene	2	2,020	129	802
Chimacum	3	745	180	2,472
Dabob-Thorndyke	1	120	109	511
Indian-Marrowstone	0	0	218	206
Little Quilcene	3	569	154	158
Ludlow	6	473	358	2,271
Miller	4	1,740	151	1,161
Quimper	4	460	118	1,901
Salmon-Snow	0	0	36	29
West Sequim Bay	0	0	130	428
TOTAL	**23**	**6,127**	**1,583**	**9,940**

[1]Applications are shown in gallons per minute (GPM) because the total amount of acre-feet usually is negotiated during the application process.

[2]Claims and rights are shown in acre-feet per year.

The holders of these water rights use them primarily for domestic multiple wells (56 percent), municipal water (16 percent), and irrigation (15 percent). Fish propagation accounts for about 10 percent of the consumptive water rights in WRIA 17.

Most domestic wells are exempt from the water rights application process, and are granted a water right of 5,000 gallons per day. Because they are exempt, these water rights are not included in Table 2. Population estimates indicate that there are over 5,000 single-family domestic wells in WRIA 17, which would amount to an additional allocation of 28,000 acre-feet/year of groundwater. However, it is unlikely that most households use their entire water right. A more reasonable estimate is 500 gallons per day, or about 2,800 acre-feet per year, which is about 28 percent of the total registered groundwater rights in WRIA 17.

As implied above, actual water use can be less than the amount of water allocated in a basin. The WRIA 17 Technical Assessment also contains an estimate of water use in the watershed, based on reports from

public water systems and estimates of irrigation and domestic use. For the purposes of this assessment, the consultants assumed that each hookup to a domestic well consumes 250 gallons/day. Table 3 shows total groundwater use in each sub-basin of WRIA 17.

Table 3: Estimated Groundwater Use in WRIA 17

Sub-basin	Irrigation Rights/Claims (af/yr)	Reported Use (af/yr)	Public Water Systems (af/yr)	Single Domestic Well Use (af/yr)	Total Groundwater Use (af/yr)
Big Quilcene	120	0	16.7	165.1	302
Chimacum	1,139	530	2.8	289.8	1,961
Dabob-Thorndyke	24	0	17.7	47.4	89
Indian-Marrowstone	184	0	2.4	101.2	287
Little Quilcene	108	0	10.6	168.4	287
Ludlow	949	278	31.7	136.7	1,395
Miller	159	75	34.3	43.4	312
Quimper	216	109	158.7	171.3	654
Salmon-Snow	10	0	1.4	146.6	158
West Sequim Bay	77	0	92.5	134.8	304
WRIA 17	**2,984**	**992**	**369**	**1,405**	**5,749**

Table 4 compares groundwater recharge to groundwater use in WRIA 17. As discussed above, estimated groundwater recharge in WRIA 17 is about 140,000 acre-feet per year, while actual groundwater use, taking single domestic wells into account, is about 5,750 acre-feet per year. Actual groundwater use amounts to only about 4 percent of recharge, while the legally allowable groundwater use represents up to 28 percent of recharge if all applications, claims, rights, and the full allocation to domestic wells are counted. While recharge may seem more than adequate to handle the use, these figures do not account for the role of groundwater in providing baseflow to streams and rivers, and do not differentiate between high and low flow periods. Evaluation of whether enough groundwater exists to allow additional withdrawals should be made on a case-by-case basis.

Table 4: Groundwater Recharge vs. Actual Groundwater Use

Sub-basin	Estimated Groundwater Recharge (af/yr)	Total Rights and Claims (af/yr)	Estimated Single Domestic Well Use (af/yr)	Net Groundwater Recharge (af/yr)
Big Quilcene	10,279	802	165.1	9,312
Little Quilcene	14,652	158	168.4	14,326
Dabob-Thorndyke	39,743	511	47.4	39,185
Ludlow	21,237	2,271	136.7	18,829
Chimacum	18,712	2,472	289.8	15,950
Salmon-Snow	9,461	29	146.6	9,285
West Sequim	6,478	428	134.8	5,915
Miller	8,115	1,161	43.4	6,911
Quimper	8,980	1,901	171.3	6,908
Indian-Marrowstone	3,002	206	101.2	2,695
WRIA 17	**140,659**	**9,939**	**1,405**	**129,315**

3.2.1.3 Surface Water Quantity

Several organizations collect surface water quantity information in WRIA 17. The United States Geological Survey (USGS) maintains gauges on six streams and rivers in WRIA 17, but only one, on the Big Quilcene River, is active. With the help of the USGS, the City of Port Townsend monitors another gauge on the Little Quilcene River at its diversion dam. The PUD collects stream flow data on Chimacum Creek, in partnership with the Jefferson County Conservation District.

According to the Technical Assessment, the annual discharge from the Big Quilcene River is about 150,000 acre-feet at the mouth, the discharge from the Little Quilcene River is about 40,000 acre-feet at the mouth, and the discharge from Chimacum Creek is about 30,000 acre-feet at the mouth. Water quantity information is not available for the other streams and rivers in WRIA 17.

The Technical Assessment compares the limited water quantity information available to optimum instream flows for salmonid species. According to this analysis, the optimum instream flows far exceed the estimated streamflows expected during median years, and also are greater than flows expected in wet years during the times that salmon need the water to be in the streams. In other words, according to this analysis, at certain times of year there is not enough water in the streams to provide optimal habitat.

3.2.1.4 Surface Water Allocation and Use

Water right permits and certificates in WRIA 17 total 198 cfs, not including numerous claims for an undetermined quantity of withdrawal. The City of Port Townsend, with a water right of 30 cfs[1] from the Big Quilcene River and 9.56 cfs from the Little Quilcene River, and the Quilcene National Fish Hatchery, with water rights totaling 40 cfs from the Big Quilcene River and 25 cfs from Penny Creek, are the largest surface water users within the WRIA. The remaining water rights include 12 individual permits totaling 57.5 cfs and 390 of 1 cfs or less (Washington Department of Ecology, 1998).

Surface water discharge fluctuates significantly with seasonal rain and snowfall. Estimating net surface water available requires review of individual water rights for permitted withdrawals along with consideration of seasonal stream flows. For example, Big Quilcene River flows average 251 cfs in January and 46 cfs in September (Orsborn and Orsborn, 2002). There are a total of 96 cfs of water rights on Big Quilcene River and its tributaries (USDA Forest Service, 1994). Not considering season permit restrictions, net surface water available would average 155 cfs in January and a negative 50 cfs in September; however, water used by the hatchery is returned to the river after use.

3.2.1.5 Hydraulic Continuity

Hydraulic continuity is the connection between groundwater and surface water bodies. Usually, an aquifer is in hydraulic continuity with lakes, streams, rivers, and other surface water-bodies when saturation is continuous to the water-bodies' edges. Hydraulic continuity explains why pumping groundwater from one location can cause changes in the flow of a river or stream in another location.

The Technical Assessment contains an evaluation of the relative hydraulic continuity potential, or RHCP, of water bodies in WRIA 17. The intent of this analysis was to differentiate between three types of streams: those that are connected to principal aquifers, those that are connected to shallow, localized aquifers, and those that are connected to bedrock or till. The term principal aquifer was defined as a groundwater system that could supply groundwater to most of the wells that are completed in that area. Streams connected to principal aquifers received high ratings, streams connected to shallow aquifers received medium ratings, and streams flowing through bedrock received low ratings.

It is important to note that RHCP is a relative analysis that was estimated based on surficial geology rather than on detailed hydraulic or hydrogeologic analysis. Therefore, it is useful for identifying areas that may require more focused study, rather than for making decisions about water withdrawals. However, streams in areas that received high rankings in this analysis are more likely to be sensitive to groundwater withdrawals than streams that received low rankings.

Portions of Tarboo Creek, Thorndyke Creek, Shine Creek, and Ludlow Creek are connected to principal aquifers and received high RHCP ratings. The valleys of Chimacum Creek received a medium-high RHCP because they cut into principal aquifer materials but include a surficial layer of low permeability peat or

[1] The1998 WRTS database lists the City of Port Townsend as having a water right certificate for 53 cfs from the Big Quilcene River. The actual water right is 30 cfs and the summary of water rights above reflects the correct number.

marsh materials. Many stream segments in the Salmon-Snow, Little Quilcene, and Big Quilcene sub-basins received medium RHCP ratings because they are situated in outwash channels or alluvial valleys that provide a shallow, localized aquifer, but are separated from principal aquifer materials.

3.2.2 SUB-BASIN SUMMARIES

This section summarizes information about groundwater quantity, surface water quantity, and hydraulic continuity for each of the ten sub-basins in WRIA 17.

3.2.2.1 Indian-Marrowstone Sub-basin

The estimated groundwater recharge in the Indian-Marrowstone Sub-basin is 3,000 acre-feet per year. The total groundwater withdrawal from the sub-basin, assuming a domestic use of 250 gallons per day, is about 287 acre-feet per year. On Marrowstone Island, the prevalence of septic systems indicates that much of this water is returned to the ground.

There are no surface-water rights in the Indian-Marrowstone Sub-basin, and there are no major surface streams.

3.2.2.2 Quimper Sub-basin

Groundwater recharge in the Quimper Sub-basin is estimated to be about 8,980 acre-feet per year, and is limited by precipitation rather than geology. No surface water quantity data were available for this sub-basin.

Assuming a domestic withdrawal rate of 250 gallons per day, the estimated groundwater use in the Quimper Sub-basin is about 654 acre-feet per year. Outside areas served by the Port Townsend water system, most users rely on septic systems. The consumptive use of groundwater in this sub-basin, then, is less than the 654 acre-feet per year due to percolation back into the ground through septic systems (Parametrix et al., 2000) and from landscaping uses of water from the Port Townsend water system (City of Port Townsend, 2003).

Very few rights to surface water withdrawals have been issued in the Quimper Sub-basin, and all are for domestic multiple households. However, while these rights are for instantaneous withdrawals of 0.02 cubic feet per second, they do not list acre-feet per year. Surface water claims in the sub-basin add up to 180 acre-feet per year.

Data from the USGS indicate that only one stream in the Quimper Sub-basin has perennial flow. This stream drains to Discovery Bay near the Chevy Chase Golf Course, and received a high RHCP rating because it flows through sediments that contain a principal aquifer.

3.2.2.3 Chimacum Sub-basin

In the Chimacum Sub-basin, groundwater recharge is estimated to be 18,700 acre-feet per year. Two stream gauges provide estimates of surface water quantity in the sub-basin. One, on the West Fork of Chimacum Creek, shows the expected pattern of high flows between December and April and low flows in September and October. The USGS operated that gauge between 1952 and 1957. The other gauge, downstream of the confluence of the east and west forks of Chimacum Creek, provides a record of streamflows from 1998 to the present (City of Port Townsend, 2003). The data from this gauge show a high of about 220 cubic feet per second in January 1998, and a low of nearly zero cubic feet per second in August 1998. The Jefferson County Conservation District and the City of Port Townsend operate this gauge.

Total groundwater withdrawal in the Chimacum Sub-basin is estimated to be 1,961 acre-feet per year, assuming a domestic use rate of 250 gallons per day. Like the Quimper and Indian-Marrowstone Sub-basins, many households in the Chimacum Sub-basin rely on septic systems. As a result, much of the groundwater withdrawn in this sub-basin likely is returned to the ground.

Consumptive surface water rights in the sub-basin total 580 acre-feet per year. The vast majority (98 percent) of this water is used for irrigation. The remaining two percent is split between domestic uses and stock watering.

Most streams in the Chimacum Sub-basin received a high or medium-high RHCP rating because they flow through sediments that comprise a principal aquifer. In some areas, streams flow through bedrock or till and receive low RHPC ratings.

The Technical Assessment reports that the Chimacum Sub-basin is one area in the watershed where some data exist to test the RHCP ratings. A 24-hour pump test was conducted at the Sparling Wellfield, which is about a half-mile west of Chimacum Creek in sediments that comprise a principal aquifer. Following the Technical Assessment's RHCP methodology, this area received a high RHPC rating. However, the pump test showed that withdrawing water from this section of the aquifer had little to no effect upon Chimacum Creek, indicating that hydraulic continuity there is not high. The Technical Assessment recommends further monitoring to better estimate hydraulic continuity at the site.

3.2.2.4 Ludlow Sub-basin

The estimated groundwater recharge in the Ludlow Sub-basin is 21,200 acre-feet per year. No surface water quantity data are available for this sub-basin.

Groundwater withdrawals in the sub-basin, assuming domestic use rate of 250 gallons per day, total 1,395 acre-feet per year. Approximately 92 percent of this use is for domestic multiple or municipal use, and about 7 percent is for irrigation.

Surface water withdrawals total 582 acre-feet per year. An estimated 97 percent of this water is used for irrigation; the remaining 3 percent is for domestic and municipal uses.

Like the Chimacum Sub-basin, most streams in the Ludlow Sub-basin received a high RHCP rating. These streams have cut downward through till so that they now flow through principal aquifer sediments. The upper reaches of Ludlow Creek received a medium-high rating because low permeability bog sediments are present that could limit hydraulic continuity. Streams that flow across outwash or alluvial sediments that overlie till received a medium RHCP rating, and those that flow through till received a low rating.

3.2.2.5 Dabob-Thorndyke Sub-basin

Total estimated groundwater recharge for the Dabob-Thorndyke Sub-basin is 39,750 acre-feet per year. This relatively high rate of recharge results from high annual precipitation (39 inches per year) falling on mostly outwash sediments, which are more permeable than till. No surface water quantity data were available for this sub-basin.

The estimated total groundwater withdrawal, assuming a domestic rate of 250 gallons per day, is 89 acre-feet per year. Approximately 51 percent of the groundwater withdrawals are for fish propagation, and about 46 percent s for domestic use. Because septic systems are common in the sub-basin, much of this water likely is returned to the system.

Surface water withdrawals total 83 acre-feet per year in the Dabob-Thorndyke Sub-basin. About two-thirds of this water is used for irrigation; the remaining water is withdrawn for domestic use.

Most of the streams in the Dabob-Thorndyke Sub-basin received high RHCP ratings because they flow through principal aquifer materials. Some streams flow through till; these streams received low rankings.

3.2.2.6 Miller Sub-basin

Groundwater recharge in the Miller Sub-basin is estimated to be 8,100 acre-feet per year. No surface water quantity data were available.

Total groundwater withdrawal, assuming a domestic rate of 250 gallons per day, is estimated to be 312 acre-feet per year. Approximately 95 percent of this water is for domestic purposes, 4 percent is for irrigation, and 1 percent is for commercial and industrial uses. Although these estimates relied partly on well logs and therefore may underestimate groundwater use, all households in the sub-basin use septic systems, reducing the consumptive use of groundwater.

Surface water withdrawals total 146 acre-feet per year, 98 percent of which is for irrigation. The remaining 2 percent is for domestic use.

Two major streams in the Miller Sub-basin received RHCP rankings. Eagle Creek mostly flows over bedrock and till, and receives a low ranking. However, at its mouth the creek may cut down into principal aquifer sediments and exhibit high RHCP. Similarly, Contractor Creek initially flows over bedrock and till, and therefore merits a low ranking. However, near its mouth it cuts through outwash sediments, improving its ranking to medium. At its mouth the creek finally meets principal aquifer sediments and receives a high RHCP ranking.

3.2.2.7 West Sequim Bay Sub-basin

Groundwater recharge in the West Sequim Bay Sub-basin is approximately 6,500 acre-feet per year. About 75 percent of the sub-basin is bedrock, which limits recharge. No surface water quantity data were available for this sub-basin.

Groundwater withdrawals, assuming a domestic rate of 250 gallons per day, total 304 acre-feet per year. Approximately 94 percent of groundwater rights are for domestic use, and 6 percent are for irrigation.

Surface water withdrawals total an estimated 809 acre-feet per year. Ninety-fiver percent of this water is used for irrigation; the remainder is withdrawn for domestic use and for watering stock.

All major streams in the West Sequim Bay Sub-basin were assigned a low RHCP ranking because they flow across bedrock or till. Near the head of Sequim Bay, however, they flow through deltaic deposits and therefore merit a medium ranking. Chicken Coop Creek may cut into principal aquifer sediments at its mouth, and received a high RHCP ranking there.

3.2.2.8 Salmon-Snow Sub-basin

The estimated groundwater recharge for the Salmon-Snow Sub-basin is 9,460 acre-feet per year. This relatively low recharge rate is the result of extensive areas of bedrock in the basin.

Surface water quantity data are available for Snow Creek. The data show the expected pattern of peak flows between December and March, and low flows from August to October. Figure 13-4 of the Technical Assessment shows the exceedance curves for Snow Creek and how they compare to optimum instream flows for a variety of salmon species' spawning requirements.

Estimated groundwater withdrawals, assuming a domestic use rate of 250 gallons per day, total 158 acre-feet per year. All of the groundwater rights in the sub-basin are for domestic use.

Surface water rights in the Salmon-Snow Sub-basin total 258 acre-feet per year. Like the West Sequim Bay Sub-basin, 98 percent of this water is used for irrigation; the remaining water is for domestic uses.

Most streams in the Salmon-Snow Sub-basin received a low RHCP ranking because they flow over bedrock or till. Some streams received a medium ranking where they flow over outwash sediments.

3.2.2.9 Little Quilcene Sub-basin

In the Little Quilcene Sub-basin, groundwater recharge is estimated at approximately 14,650 acre-feet per year. Some surface water quantity data are available for the Little Quilcene. The City of Port Townsend operates a gauge at its diversion on the Little Quilcene; the gauge is read daily (Jablonski, 2003). According to this gauge, peak flows on the Little Quilcene occur between December and March, and average approximately 52 cubic feet per second above the diversion and 48 cubic feet per second below the diversion. Low flows occur in September and October, and range between 4 and 8 cubic feet per second both above and below the diversion.

Total groundwater use in the Little Quilcene Sub-basin, assuming a domestic use rate of 250 gallons per day, is about 287 acre-feet per year. About 70 percent of the groundwater rights are used for domestic purposes, and about 29 percent are used for irrigation. Because septic tanks are used throughout the sub-basin, much of this water likely is returned to the system.

The City of Port Townsend holds a water right for 9.56 cfs from the Little Quilcene River (Washington Department of Ecology, 1998).

Streams that run through bedrock and till-covered areas in the sub-basin received low RHCP rankings, although many of these streams encounter alluvial sediments at their mouths and receive medium rankings there. The mouth of the Little Quilcene received a high RHCP ranking while the mouths of Donovan and Jakeway Creeks received medium-high rankings.

3.2.2.10 Big Quilcene Sub-basin

Total groundwater recharge in the Big Quilcene Sub-basin is estimated to be 10,300 acre-feet per year. This relatively low recharge rate, given the high precipitation rate, is because 92 percent of the sub-basin is bedrock.

Two active gauges record surface water quantity data on the Big Quilcene River. One is downstream of the City of Port Townsend's diversion dam, and the other is at Linger Longer Bridge. The USGS maintains the former gauge and the Department of Ecology maintains the latter (Jablonski, 2003). The USGS gauge shows peak flows between December and March, with a smaller peak in May and June during snowmelt, and low flows between August and October. Between 1993 and 1999, peak flows averaged about 270 cubic feet per second and low flows averaged about 60 cubic feet per second above the City's diversion dam. Below the diversion, peak flows averaged about 250 cubic feet per second and low flows averaged about 30 cubic feet per second. The City restricts its diversion when flows dip below 51 cubic feet per second, and stops diverting altogether when flows reach 27 cubic feet per second.

Total groundwater withdrawal in the sub-basin, assuming a domestic use rate of 250 gallons per day, is estimated to be 302 acre-feet per year. Because septic systems are common in the sub-basin, the consumptive use of groundwater likely is less than this total. Of the 17 groundwater rights in the basin, approximately 72 percent of the total allocation is for fish propagation. This water is returned to the river. The remaining rights are for domestic uses and irrigation.

As implied above, surface water is diverted at two locations on the Big Quilcene: at river mile (RM) 9.3 for the City of Port Townsend and the Port Townsend Paper Company, and at RM 2.8 for the Quilcene National Fish Hatchery. The City's water right is for 30 cfs, and the Fish Hatchery's right is for 40 cfs (Washington Department of Ecology, 1998). The Fish Hatchery returns water to the river after use. Surface water rights on the Big Quilcene and its tributaries total 96 cfs (USDA Forest Service, 1994).

RHCP ranked low in the bedrock and till-covered areas of the basin, and medium through the alluvial and recessional outwash sediments along the Big Quilcene River. Near the mouth of the Big Quilcene, RHCP is ranked medium-high because the river may cut through the till layer to reach the aquifer. At its mouth, the river is in the principal aquifer sediments and merits a high ranking.

3.3 Water Quality

This section presents an overview of surface and groundwater quality in WRIA 17, followed by discussions of water quality in each of the WRIA 17 sub-basins. The information in this section is drawn from the WRIA 17 Technical Assessment (Parametrix et al., 2000) unless otherwise noted.

3.3.1 WATER QUALITY OVERVIEW

3.3.1.1 Surface Water Quality

In general, freshwater and marine water quality in WRIA 17 is good where it has been measured, although some areas have fair to poor water quality. Most of the monitoring studies conducted in the watershed have measured temperature and fecal coliform bacteria concentrations, although some have evaluated physical characteristics such as dissolved oxygen, pH, conductivity, total suspended solids, and turbidity. Only limited amounts of information are available for nutrients such as nitrate and total phosphorus, and even less is available for inorganic and organic compounds.

Using these data, the Washington State Department of Ecology identifies streams that do not meet water quality standards, and places them on a list called the 303(d) list, as required under the federal Clean Water Act. In 1998, the following water bodies were on the 303(d) list (Washington Department of Ecology, 2000):

- Big Quilcene River
- Chicken Coop Creek
- Chimacum Creek
- Dabob and Quilcene Bay
- Donovan Creek
- Jackson Creek
- Johnson Creek
- Leland Creek
- Little Quilcene River
- Marple Creek
- Ripley Creek
- Sequim Bay
- Tarboo Creek
- Thorndyke Creek (West Fork)

The water quality standards that these water bodies did not meet include one or more of the following: fecal coliform levels, water temperature, fish habitat, instream flow, dissolved oxygen, PAHs in sediment, and pH. The WRIA 17 Technical Assessment contains more information about the water bodies on the 303(d) list.

Provisions of the Clean Water Act require Ecology to develop total maximum daily loads, or TMDLs, for water bodies on the 303(d) list. TMDLs are clean-up plans that include an analysis of how much of a pollutant a water body can receive and still meet water quality standards. As of 2000, no TMDLs had been completed in WRIA 17.

TMDLs account for natural, or background, sources of pollutants, and also the sum of point and non-point pollution. The Technical Assessment identified 114 regulated point sources of pollution that have National Pollution Discharge Elimination System (NPDES) permits in WRIA 17. Non-point pollution sources are by nature more diffuse, and are discussed under each sub-basin below.

In some sub-basins, organizations have worked aggressively to reduce non-point pollution. For example, Jefferson County and the Jefferson County Conservation District have worked with the owners of more

than 30 on-site septic systems in the Quilcene Bay watershed to reduce leakage. The Conservation District also has worked with property owners to restrict livestock access to streams, constructing 14,000 feet of fence in the Little Quilcene Sub-basin, 20,000 feet in the Dabob-Thorndyke Sub-basin, 11,000 feet in the Salmon-Snow Sub-basin, and 53,000 feet in the Chimacum Sub-basin since 1988.

3.3.1.2 Groundwater Quality

Groundwater quality, like surface water quality, generally is good in WRIA 17. The contaminants of concern in the watershed are chloride, nitrate, iron, and manganese.

Elevated chloride concentrations usually indicate saltwater intrusion into a well, and therefore generally are found near the coast. However, chloride also can come from salty water trapped naturally underground. In WRIA 17, scattered instances of coastal wells with elevated chloride occur in all sub-basins with extensive coastlines. However, high chloride is common on Marrowstone Island, along portions of the Ludlow Sub-basin coastline, in inland locations in the Big and Little Quilcene Sub-basins, along West Sequim Bay, and near Gardiner in the Miller Sub-basin. Many of these wells with high chloride concentrations are adjacent to wells showing normal chloride. Because the causes of saltwater intrusion are multiple and complex, one should not assume that groundwater pumping is always the cause.

For the most part (82 percent), nitrate concentrations are within natural concentrations, or are only slightly above normal (10 percent). The remaining 8 percent of wells with elevated nitrate show no pattern throughout the watershed. However, they mostly occur in the Indian-Marrowstone, Chimacum, Dabob-Thorndyke, and Little Quilcene Sub-basins. The Quimper and Ludlow Sub-basins also have some wells with elevated nitrate.

Elevated concentrations of iron and manganese are common in the groundwater in WRIA 17. The subsurface conditions that control concentrations of these elements are complex and cannot be predicted easily.

Seven cases of groundwater contamination from hazardous sites were identified in the Technical Assessment. Three occur at the US Navy installation on Indian Island, three occur in Port Townsend, and one occurs in Quilcene (City of Port Townsend, 2003). The contaminants at these sites vary widely and include heavy metals, halogenated organics, non-halogenated solvents, PCBs, pesticides, petroleum products, and other unspecified organic matter. In addition, thirteen sites with leaking underground storage tanks have contaminated groundwater with petroleum products in Port Townsend, Nordland, Chimacum, Port Ludlow, and Quilcene.

3.3.2 SUB-BASIN SUMMARIES

This section summarizes information from the WRIA 17 Technical Assessment about the water quality in each of the ten sub-basins of WRIA 17. The interested reader is directed to the Technical Assessment for further information and details.

3.3.2.1 Indian-Marrowstone Sub-basin

Although no water quality data were available for freshwater features in this sub-basin, marine water quality in Killisut Harbor has been monitored and generally is good. The Department of Health allows shellfish harvesting in the harbor.

Six point sources of pollutants in this sub-basin have NPDES permits: FUDS Fort Flagler, Fort Flagler State Park Sewer Treatment Plant, US Navy Port Hadlock, and US Navy Port Hadlock Areas 10 and 21,

11, and 12. No monitoring data or compliance problems were reported for these point sources. Likewise, the Technical Assessment identified no sources of non-point pollution in this sub-basin.

Groundwater quality data are not available for Indian Island and the northern portion of Marrowstone Island because both areas import drinking water. However, the remainder of Marrowstone Island has a high density of groundwater wells with elevated chloride concentrations, especially those that are near the coast, were completed below sea level, or receive high use. Although no one disagrees that high concentrations of chloride occur, general consensus around the cause of these concentrations has not been achieved. Some wells may have tapped naturally salty water, while others may be located in the zone of diffusion between fresh and saltwater. However, given that background concentrations of chloride on the island are low, wells near the coast with elevated chloride likely are subject to saltwater intrusion.

Most wells on Marrowstone Island have natural concentrations of nitrate-nitrogen. However, one cluster of elevated concentrations occurs near East Beach Park, and several isolated cases of mildly elevated concentrations occur on the island.

The leaking underground storage tank that contaminated groundwater in Nordland has been cleaned up, and monitoring is ongoing. Three other tanks at the naval station have contaminated groundwater, but because the station imports its water, its drinking water supply is not affected.

3.3.2.2 Quimper Sub-basin

No water quality data on fresh surface water features were available for this sub-basin. The Quimper Sub-basin discharges to Discovery Bay and Port Townsend Bay. The water quality of these marine bodies is good, and is discussed under the Salmon-Snow Sub-basin and the Chimacum Sub-basin, respectively.

There are almost fifty point sources that have NPDES permits in the Quimper Sub-basin. The WRIA 17 Technical Assessment contains a complete list of these permits, which mostly are for industrial processes within the City of Port Townsend and discharge into Port Townsend Bay. The Port Townsend wastewater department is one of the top-rated treatment operations in the state, and has received numerous awards from the Washington Department of Ecology for superior performance (City of Port Townsend, 2003).

Non-point pollution in the Quimper Sub-basin comes primarily from the residential and urban areas. The City of Port Townsend is considered a source of non-point pollution in Port Townsend Bay, and runoff from the city currently runs untreated into Port Townsend Bay. Cape George and Beckett Point also are susceptible to fecal coliform contamination from leaking septic systems. Farms and livestock may also contribute to non-point pollution in the basin.

Although groundwater quality in the Quimper Sub-basin is generally good, some instances of elevated chloride concentrations occur at Kala Point and inland of Admiralty Inlet between Cape George and McCurdy Point. Scattered instances of elevated nitrate concentrations occur in the interior of the sub-basin, with a minor cluster suggested near the intersection of State Routes 19 and 20. However, more data are needed to infer nitrate contamination in this area.

Seven sites in Port Townsend have leaking storage tanks or other sources of hazardous materials that have contaminated groundwater. However, no data exist to suggest that these leaks have compromised groundwater sources of drinking water.

3.3.2.3 Chimacum Sub-basin

A variety of investigators have studied surface water quality in the Chimacum Sub-basin, primarily on Chimacum, Naylors, and Putaansuu Creeks. The WRIA 17 Technical Assessment summarizes the data

from these studies. Using these studies, the Department of Ecology placed Chimacum Creek on the 303(d) list because it exceeds temperature and fecal coliform standards.

Marine water quality, however, is generally good. The Department of Health monitors water quality in Port Townsend Bay, and allows shellfish harvesting there.

Seven point sources of pollution are regulated under NPDES permits in the Chimacum Sub-basin. However, no monitoring or compliance data were available for these point sources. Non-point sources of pollution in the basin consist mainly of livestock and hay farms, but landowners have implemented best management practices over the last 10 to 15 years, including fencing over 55,000 linear feat of stream to prevent livestock access.

Groundwater quality in the Chimacum Sub-basin also is generally good. No instances of elevated chloride occur in the basin, although a cluster of elevated nitrate concentrations is noted in the upper reaches of the watershed south of Egg and I Road. An underground storage tank at the Chimacum School District contaminated groundwater, but there is no evidence that this contamination affects drinking water supplies.

3.3.2.4 Ludlow Sub-basin

Water quality has been monitored on eight streams in this sub-basin for six years, and has remained relatively stable during that period. The streams include three tributaries to Mats Mats Bay, Ludlow Creek, Shine Creek, and Ludlow Bay tributaries. No streams in the Ludlow Sub-basin are on the 303(d) list, although fecal coliform counts have been elevated in the streams periodically and sedimentation from logging unstable soils did smother a large area of salmon spawning habitat in Shine Creek.

Marine water quality also is good in the Ludlow Sub-basin. The Department of Health allows commercial shellfish farms in Oak Bay and Mats Mats Bay, and Bywater Bay and Squamish Harbor both were well within the state standard when tested. However, Mats Mats Bay and Ludlow Bay experience low dissolved oxygen in the fall from upwelling in Admiralty Inlet and decomposing logs in the Ludlow Bay storage area. Shellfish in Mats Mats Bay periodically are contaminated with fecal coliform bacteria.

Thirteen point sources have NPDES permits in the Ludlow Sub-basin, but no monitoring or compliance data are available. Non-point sources of pollution include clearcutting in the Shine Creek drainage, runoff and stormwater from residential and agricultural areas in the Ludlow Watershed, and fecal coliform discharges from boats and marinas in Ludlow and Mats Mats Bays.

Groundwater quality also is generally good in the Ludlow Sub-basin. Elevated chloride concentrations from saltwater intrusion occur in small clusters along Oak Bay and Mats Mats Bay, and along the coast between Bywater Bay and south of Squamish Harbor. Isolated instances of elevated chloride occur on a small peninsula on the south side of Ludlow Bay and at Oak Point.

Nitrate is not a problem in the Ludlow Sub-basin, although some wells show mild elevations of nitrate and four have elevated nitrate. The Port Ludlow Golf Course has a leaking underground storage tank that contaminated groundwater, but there is no data that suggest that the leak also contaminated drinking water supplies. The owners of the golf course have begun cleaning up the site.

3.3.2.5 Dabob-Thorndyke Sub-basin

Water quality monitoring in this sub-basin has occurred on Tarboo, Thorndyke, and Coyle Creeks. Based upon these data, the Department of Ecology has placed Tarboo Creek and Thorndyke Creek (West Fork) on the 303(d) list because they exceed temperature standards for Class AA streams.

There are three marine water bodies in this sub-basin: Dabob Bay, Thorndyke Bay, and Tarboo Bay. Monitoring data in Dabob and Thorndyke Bays indicate that water quality is good in both bays, and both have been opened to shellfish harvesting. The WRIA 17 Technical Assessment does not report any water quality data for Tarboo Bay.

Only two point sources have NPDES permits in the Dabob-Thorndyke Sub-basin: Big Lake Outlet Structure and Jefferson County PW Coyle Pit. No monitoring or compliance data are available for these point sources.

Non-point pollution is the main water quality threat in this sub-basin. Studies have identified three potential sources of fecal coliform contamination: agricultural practices, failing septic systems, and native populations of harbor seals. Agricultural practices in the Tarboo Bay basin were identified as the primary source of fecal coliform in the area.

Groundwater quality is generally good in the Dabob-Thorndyke Sub-basin. Most wells show natural levels of chloride and nitrate, although scattered occurrences of elevated chloride occur along the coast and a few wells have elevated nitrate concentrations. There are no sites in the Dabob-Thorndyke Sub-basin with groundwater contamination from tanks or other anthropogenic sources.

3.3.2.6 Miller Sub-basin

Freshwater quality information for the Miller Sub-basin is limited. One study on Contractors Creek showed that the creek has low fecal coliform levels and meets state standards.

The Miller Sub-basin drains to Discovery Bay and Sequim Bay. These marine water bodies are discussed under the Salmon-Snow and Sequim Bay Sub-basin sections, respectively. In brief, water quality in Discovery Bay is good, but Sequim Bay has problems with pH, dissolved oxygen, fecal coliform, and polycyclic aromatic hydrocarbons (PAH).

Four point sources have NPDES permits in the Miller Sub-basin: Westerman Dam No 2, Stoddard International, Westerman Dam No 1, and J and D East Gravel Pit. No monitoring or compliance data are available for these point sources.

Two studies identified specific non-point sources of pollution in the sub-basin: on Contractor Creek, undersized ditches and lack of culverts cause floods which carry sediments to downstream intermittent streams and wetlands, and several drains near Diamond Point carry pollution straight into Discovery Bay. However, agricultural practices and failing septic systems also may contribute non-point pollution to streams and Discovery Bay.

Elevated chloride concentrations are common in the Miller Sub-basin. A cluster of seven coastal wells with high chloride occurs near Gardiner. Wells near Diamond Point, south of Point Discovery and on the eastern shore of Sequim Bay show elevated chloride concentrations. Inland wells near Gardiner also show elevated levels of chloride, suggesting natural sources of chloride at those locations. Although the investigation conducted for the Technical Assessment cannot differentiate between natural and pumping-induced sources of chloride contamination, the report recommends using caution before developing additional groundwater sources from coastal areas with known elevated chloride.

No wells for which data exist in the Miller Sub-basin show elevated nitrate, and no sources of anthropogenic contamination were reported.

3.3.2.7 West Sequim Bay Sub-basin

The Department of Ecology states that Jimmycomelately Creek generally has good water quality. However, Chicken Coop Creek and Johnson Creek are on the 1998 303(d) list because they do not meet state fecal coliform bacteria standards.

Sequim Bay is also on the 303(d) list because it exceeds pH, dissolved oxygen, fecal coliform, and polycyclic aromatic hydrocarbon (PAH) apparent effects thresholds. The Department of Health prohibits shellfish harvesting at the mouth of Sequim Bay as a result of non-point pollution in Bell Creek (Parametrix et al., 2000), at the mouth of Johnson Creek, and around the John Wayne Marina (Soule, 2003). The Department of Health approves the rest of the bay with the exception of a seasonal closure due to summer boat traffic at Sequim Bay State Park (Soule, 2003). Ten sources of non-point pollution have NPDES permits in the West Sequim Bay Sub-basin.

Forestry and agriculture are the main sources of non-point pollution for this sub-basin, especially since urban and residential land uses are rare. Several irrigation ditches contribute fecal coliform bacteria to Bell and Johnson Creeks, and an Ecology study indicates that Bell Creek (in WRIA 18) is the single largest source of bacteria to Sequim Bay. The Jamestown S'Klallam Tribe and the City of Sequim have collected monitoring data that indicate that with the exception of Bell Creek, most sub-basin tributaries have fecal coliform levels that meet clean water standards. Monitoring data on Bell Creek show significant improvement in water quality since the early 1990s (Soule, 2003).

Four coastal wells in the West Sequim Bay Sub-basin show elevated levels of chloride (Parametrix et al., 2000), and seawater intrusion has occurred in the past (Soule, 2003). Although nitrate data were available for only six wells, only one shows an elevated level of nitrate.

3.3.2.8 Salmon-Snow Sub-basin

Although no streams in this sub-basin are on the 303(d) list, several studies have shown that creeks exceed state water quality standards for Class AA streams as follows:

- Snow Creek does not meet temperature, dissolved oxygen, and fecal coliform bacteria standards;
- Andrews Creek does not meet fecal coliform, temperature, dissolved oxygen, and turbidity standards;
- Salmon Creek does not meet fecal coliform standards at its mouth; and
- Houck Creek also does not meet fecal coliform standards at its mouth.

However, dissolved oxygen concentrations on Andrews Creek improved between 1994 and 1999, likely due to channel restoration work completed in 1995.

Marine water quality in this sub-basin is good. The Department of Health allows shellfish harvesting in Discovery Bay, although it has identified the southern portion of the bay as a high threat area for harvesting because of local land use and the potential for water quality to degrade.

Two point sources have NPDES permits in the Salmon-Snow Sub-basin: Hammeren James and US 101/SR 104 Drums. No monitoring or compliance data were available for these point sources.

The primary sources of non-point pollution in the sub-basin are forestry and agricultural operations, and the two primary pollutants are fecal coliform and sediment. Very few people live in the sub-basin, and though failing septic systems and urban runoff occur, they are not considered major sources of pollution.

Groundwater quality data are sparse in this sub-basin; chloride concentrations were available for only nine wells. Of these, eight showed natural concentrations and one well on Discovery Bay at the mouth of Salmon Creek had an elevated concentration. Three of ten wells for which nitrate data were available had

elevated nitrate concentrations. No sources of anthropogenic groundwater contamination were reported for this sub-basin.

3.3.2.9 Little Quilcene Sub-basin

Extensive water quality monitoring has occurred in the Little Quilcene Sub-basin. The data show that temperature has been a problem in the Little Quilcene River, Donovan Creek, Leland Creek, and Jakeway Creek. Donovan Creek and Jakeway Creek also experience low dissolved oxygen concentrations, and portions of Quilcene Bay and Donovan Creek have fecal coliform problems. All of these water bodies except Jakeway Creek were on the 303(d) list in 1998.

All streams in the Little Quilcene Sub-basin drain to Quilcene Bay, which is discussed further under the Big Quilcene Sub-basin below. Marine water quality in Quilcene Bay is excellent.

Six point sources have NPDES permits in the Little Quilcene Sub-basin. No monitoring or compliance problem data were available for these sources.

Historically, residential development and agriculture were the prime suspects for the levels of fecal coliform measured in the Little Quilcene River. Livestock were fenced away from tidally inundated pastures in 1988, and away from portions of Donovan Creek. Two studies have shown a general trend of decreasing fecal coliform levels in the sub-basin, but existing data are insufficient for determining whether these trends are statistically significant or are the result of climatic conditions.

All of the coastal wells in the Little Quilcene Sub-basin show natural levels of chloride, but four inland wells have elevated chloride. Although only a moderate amount of data exist on nitrate in the sub-basin, many of the measurements show at least mildly elevated nitrate concentrations, and several show high concentrations.

There is one suspected case of groundwater contamination from hazardous waste and five cases of contamination from petroleum products in Quilcene. The Town of Quilcene is in both the Little and Big Quilcene Sub-basins, and the Technical Assessment does not determine which sub-basin contains the contaminated sites. Two of the petroleum cases have been cleaned up, two others have started cleanup, and one is being monitored (Parametrix et al., 2000). In the early 1990s, elevated levels of benzene in groundwater required residents to use bottled water for a short period. This situation was a one-time event and has not recurred (City of Port Townsend, 2003).

3.3.2.10 Big Quilcene Sub-basin

Water quality in the Big Quilcene Sub-basin generally is good. The Big Quilcene River is on the 303(d) list because it does not meet fish habitat and instream flow criteria, not because of poor water quality. No other streams in the basin are on the 303(d) list.

Marine water quality in Quilcene Bay is excellent with the exception of the upper bay, which experiences intermittent fecal coliform problems. These problems have been attributed to natural seal populations, animal husbandry practices, and leaking septic systems. Monitoring from 1994 to 1998 showed that fecal coliform was not a problem in Quilcene Bay, and as of 1999 shellfish growing areas in the bay are approved except for the north section, which is unclassified.

Many groups have acted to protect water quality in this sub-basin. Examples of restoration and protective actions include Jefferson County's adoption of the watershed action plan in 1991, fencing of approximately 5,000 feet of stream corridor to prevent livestock access, repair of 31 septic systems, and a variety of projects on the Big Quilcene such as dike setbacks and removals, property buyouts, and river restoration.

There are five point sources of pollution with NPDES permits, but no monitoring or compliance problem data were available.

Non-point pollution sources in the Big Quilcene Sub-basin include septic systems, a marina on the western shore of Quilcene Bay, agricultural runoff from livestock areas, harbor seals, and erosion from forestry practices. As noted above, watershed planning has resulted in repair of septic systems and fencing of streams. Log booms that seals used for haul out areas were removed in the late 1980s, but the seals continue to haul out near the entrance to Quilcene Bay.

Groundwater quality also generally is good. Elevated chloride concentrations occur in wells in Jackson Cove, and inland near the confluence of the Big Quilcene River with Penny Creek. Although little nitrate data are available, two out of eleven wells show some degree of elevated nitrate.

As discussed above in the Little Quilcene section, groundwater contamination occurs at one suspected site and five confirmed sites in Quilcene. The community of Quilcene straddles the two sub-basins, and the Technical Assessment does not determine which sub-basin contains the contaminated sites. However, no effects on drinking water supplies from these sites were reported.

3.4 Habitat

This section presents an overview of salmonid habitat quality in WRIA 17, followed by discussions of habitat quality in each of the WRIA 17 sub-basins. Unless otherwise noted, the information in this section is drawn from the WRIA 17 Limiting Factors Assessment published by the Washington State Conservation Commission (Correa, 2002).

3.4.1 HABITAT OVERVIEW

The streams and rivers of WRIA 17 provide spawning and rearing habitats for four native species of salmonids: coho and chum salmon, and steelhead and sea-run cutthroat trout. Chinook and pink salmon also use these habitats for spawning and rearing, although not in great numbers (City of Port Townsend, 2003). The nearshore and estuarine habitats of Puget Sound also provide crucial rearing and migration habitats for juvenile salmonids of all species native to Puget Sound: coho, chinook, chum, sockeye and pink salmon, and steelhead, cutthroat and bull trout. Of these, Hood Canal summer chum, Puget Sound chinook, and bull trout are listed as threatened under the Endangered Species Act.

In WRIA 17, several rivers host Hood Canal summer chum runs, including the Big Quilcene River, the Little Quilcene River, Chimacum Creek, Snow Creek, Salmon Creek, and Jimmycomelately Creek. Although Puget Sound chinook are present in the Puget Sound areas of WRIA 17, scientists are unsure whether native chinook runs still exist in Hood Canal because this stock has mixed significantly with a variety of hatchery stocks. Although WRIA 17 does not seem to support chinook runs, artificial supplementation programs have contributed to inconsistent adult chinook returns to the Big Quilcene River and Tarboo Creek.

Fall chum runs in WRIA 17 exist in the Quilcene Bay and Dabob Bay sub-basins; these runs are considered healthy. Coho stocks have not fared as well, ranging from critical status in Discovery Bay to depressed in Quilcene, Dabob and Sequim Bay sub-basins. Very little is known about winter steelhead populations except in Discovery Bay, where stocks are depressed.

Although these salmonid species are present in WRIA 17 at different times of year and at different life stages, they all have similar habitat requirements. Each species depends upon adequate freshwater flow and water quality, ample spawning gravels, a functional riparian zone, and instream habitat structures such as large woody debris, large boulders, and pools. All species also depend upon healthy and productive nearshore and estuarine habitats, although chum and chinook salmon tend to rely on these habitats for greater periods of time than do coho, steelhead and bull trout. In the nearshore and estuarine environments, high salt marsh, eelgrass, and shallow habitats are critical to all species as they make the transition to the marine environment.

Anthropogenic changes to habitat have serious consequences for salmonid species. Coho in particular are sensitive to changes in the freshwater environment, since as juveniles they rear extensively in rivers and streams during the summer low flow period. Conversely, changes to the nearshore environment are important to chum and chinook, the two federally listed species in WRIA 17.

In WRIA 17, human activities, especially related to land use, have degraded salmon habitat. In particular, forest practices, agriculture, rural development and shoreline development have had negative effects. For example, timber harvest on state and private forestlands, if not managed properly, can result in reduced riparian habitat and increased sediment loads in streams. These changes can result in higher water temperatures, lack of large woody debris, reduced woody debris recruitment, and smothering of spawning gravels, all of which are detrimental to salmonids.

Agricultural activities in the floodplains of many WRIA 17 sub-basins have led to channelized streams, drained beaver ponds, and removal of vegetation from riparian zones. These practices have had a variety of negative effects, including reducing channel complexity, pool/riffle ratios, and bank and streambed stability, and eliminating riparian areas and juvenile rearing habitat associated with beaver ponds. In nearshore areas, farmers have diked and filled salt marshes and estuaries, interrupting nearshore processes and eliminating salt marsh habitats.

Residential development in rural areas also has led to reductions in riparian function, because residents often cut down vegetation to increase views. In some cases, removal of vegetation destabilizes banks, leading to shoreline armoring, which interrupts habitat-forming processes. Stormwater runoff introduces pesticides, chemical fertilizers and other contaminants into streams, degrading water quality.

However, some land use decisions and other efforts have resulted in positive changes in the watershed:

- The US Park Service and US Forest Service lands in WRIA 17 have some of the best habitat conditions in the watershed. The Park Service strives to maintain natural habitats through preservation, and the Forest Service has implemented a Riparian Reserve Program to provide functioning riparian habitat that ensures conifer canopy cover for water temperature control, large woody debris recruitment, streambank stability, and migratory corridors for wildlife species.
- Changes to forest practices regulations have improved protection of streams and wetlands.
- Agricultural landowners have changed their management techniques and implemented best management practices that improve and protect water quality and fish habitat (Jefferson County Conservation District, 2003).

Other groups have protected habitat in WRIA 17. For example, the Chumsortium is a coalition of agencies including the Jefferson Land Trust, Wild Olympic Salmon, Jefferson County Conservation District, North Olympic Salmon Coalition, Hood Canal Coordinating Council, Trout Unlimited, Jefferson County, and the Washington Department of Fish and Wildlife. This group has been working to find funding for the acquisition of critical salmon habitats in east Jefferson County.

3.4.2 SUB-BASIN SUMMARIES

The sections below summarize information about habitat conditions in each sub-basin of WRIA 17 that is presented in the WRIA 17 Limiting Factors Assessment (LFA) (Correa, 2002). However, it is important to note two items: these sections follow the sub-basins defined in the LFA rather than those defined in the Technical Assessment. Secondly, the LFA provides a wealth of detail about each stream. The sections below are summaries of this information and while they attempt to include important information, they are not inclusive of all data available about salmon habitat in WRIA 17.

3.4.2.1 Big Quilcene Sub-basin

The WRIA 17 LFA includes Marple/Jackson Creek, Spencer Creek, Indian George Creek, and the Big Quilcene River in this sub-basin.

In Marple/Jackson Creek development in the floodplain, including road construction, has reduced riparian buffers and channel complexity. The LFA recommends reestablishing riparian buffers, increasing channel complexity in the lower channel, and moving dikes farther away from the channel.

Mass wasting has been a problem in Spencer Creek, resulting in increased sediment loads in the stream. The LFA recommends identifying, addressing and monitoring sediment sources to the stream. In addition, several culverts on Spencer Creek and its tributaries are complete or partial barriers to fish

passage. One in particular, under a logging road in the upper watershed, is partly filled with gravel and could soon fail. The LFA recommends removing that culvert and examining ways to improve fish passage where the stream crosses Bee Mill Road.

Like Spencer Creek, Indian George Creek has had problems with mass wasting, primarily as a result of erosion from logging roads and clearcuts. In addition, logging has resulted in the loss of much of the riparian zone. The LFA recommends addressing sediment sources and revegetating the riparian zone in Indian George Creek. A recent restoration project in the estuary removed fill and barges associated with aquaculture activities, allowing shoreline processes to reassert themselves and providing shallow water habitat that is important to juvenile salmonids.

Development at the mouth of the Big Quilcene River has led to channelization, dredging, and armoring of the lower river. Diking of the Big Quilcene River began in the nineteenth century (Christensen, 2003). Cut off from its floodplain, the river has been building its delta outwards because it can no longer deposit sediments on the floodplain. Above river mile 1.1, the channel has lost complexity and sinuosity, and the Quilcene National Fish Hatchery's weir is a partial barrier to fish passage. Riparian buffers are patchy, and sediment loads in the river are above natural levels. Summer low flows may have negative effects on salmonid species. A natural waterfall blocks anadromous fish passage to the Big Quilcene River at river mile 7.8. However, conditions above the falls are important for preserving water quality downstream.

To address these limiting factors, the LFA recommends protecting and restoring habitat-forming processes in the lower river and estuary, protecting and restoring riverine function above river mile 1.1, monitoring and addressing mass wasting, and conducting hydrologic and flow studies on the Big Quilcene River.

3.4.2.2 Little Quilcene Sub-basin

The WRIA 17 LFA includes the Little Quilcene River, Leland Creek, Ripley Creek, Howe Creek, Donovan Creek, and Jakeway Creek in the Little Quilcene Sub-basin. Because Leland, Ripley, and Howe Creeks are tributaries to the Little Quilcene River, the LFA recommends actions to protect and restore salmon habitat in these four streams as a unit. Similarly, the LFA considers Donovan Creek and its tributary Jakeway Creek together.

Like the Big Quilcene, the estuary of the Little Quilcene has experienced extensive diking to protect agricultural and residential development. This diking began in the late nineteenth century. These dikes have disrupted natural habitat-forming processes, and forced the river to build its delta outwards because it can no longer deposit sediments on the floodplain. The channel lacks sinuosity and large woody debris. Riparian conditions in the lower watershed are poor but improving as buffers that were harvested grow back as conifer-dominated forests. In the upper watershed, the US Forest Service maintains riparian buffers that could contribute large woody debris to the stream. Water temperatures are elevated in the Little Quilcene and its tributaries, except in the upper reaches of the Little Quilcene. Not much is known about sediment sources in the Little Quilcene or its tributaries.

To address these conditions, the LFA recommends actions similar to those for the Big Quilcene River: restore estuarine functions, protect and restore riverine functions, conduct hydrologic and flow studies, and assess, stabilize, and monitor sediment sources.

Natural barriers to anadromous fish passage occur on both Donovan and Jakeway Creeks, at river miles 2.1 and 1.0, respectively. The Jefferson County Conservation District, Wild Olympic Salmon, and the Quilcene/Snow Jobs for the Environment Crew have corrected all artificial barriers downstream of the natural barrier on Jakeway Creek. These groups also added some large woody debris, stabilized banks with log weirs, and constructed cattle exclusion fencing between river mile 0.0 and 0.4 on Jakeway Creek.

Although not much is known about Donovan and Jakeway Creeks, the LFA notes that agricultural practices have led to channelization and incision of the stream, disconnection of the stream from its floodplain, elimination of riparian buffers, elevated water temperatures and low levels of dissolved oxygen. In addition, the East Quilcene Road crossing over Donovan Creek is a filled causeway that restricts tidal flow into the historic estuary.

To address these conditions, the LFA recommends restoring tidal flux into the Donovan Creek estuary, adding meanders and large woody debris to the stream, planting riparian buffers, and converting filled roadways to pile causeways.

3.4.2.3 Tarboo/Thorndyke Sub-basin

The LFA includes Lindsay Creek, Tarboo Creek, East Fort Tarboo Creek, Camp Discovery Creek, Fisherman Harbor Creek, and Thorndyke Creek in this sub-basin.

Lindsay Creek has a natural barrier to fish passage at river mile 1.0. Although anadromous fish cannot access the stream above this point, conditions above the falls are important for water quality. Landslides in the upper watershed have contributed large amounts of sediment to lower Lindsay Creek, resulting in sediment buildup that forces the stream to flow beneath the surface in its last quarter mile. Because the stream goes underground, fish cannot use it.

Other problems in Lindsay Creek include lack of pool habitat, unstable stream banks, poor riparian conditions, and lack of large woody debris. To address these habitat conditions, the LFA recommends identifying and abating sediment and mass wasting sources, adding structure to the stream to create bed stability, pool habitat, and cover, and planting riparian buffers to improve bank stability and provide a future source of large woody debris.

The lower reaches of Tarboo Creek are in public ownership, and have good floodplain connectivity, bank stability, sediment supply, and riparian condition. Pool structure and quality in this reach are fair. However, the estuary of Tarboo Creek is undisturbed and is of high habitat quality. The middle stretch of the creek, up to river mile 4.0, has been converted to agriculture, and suffers from a loss of riparian buffers, connectivity to the floodplain, and pool structure. Less is known about Tarboo Creek above river mile 4.0 and the East Fork of Tarboo Creek, but riparian conditions in both streams are poor, as is fish access. Water temperatures in upper Tarboo Creek are good. Two major culvert barriers occur in upper Tarboo Creek at Dabob Road and Center Road, are high on the list of county road culverts to be replaced.

To protect and restore habitat in Tarboo Creek, the LFA recommends addressing culvert barriers, adding channel sinuosity, restoring channel complexity such as large woody debris, planting riparian buffers in the middle reaches, and creating access to a pond on a left bank tributary at about river mile 1.0 and to two ponds on the right bank at river mile 2.7.

Thorndyke Creek possesses some high quality riverine and estuarine habitat. The creek has not been channelized, and it maintains good connectivity with its floodplain. The estuary has undisturbed high salt marsh habitats and extensive tidal channels. Much of the creek flows through riparian buffers or forests, but these areas contain few conifers that could become large woody debris in the future. The LFA recommends protecting high quality riverine and estuarine habitats, replacing the mainstem culvert at Thorndyke Road, and underplanting riparian areas with native conifer species.

Very little is known about habitat conditions in Camp Discovery Creek and Fisherman Harbor Creek. As a result, the LFA recommends conducting studies and assessments to fill data gaps on these streams.

3.4.2.4 Ludlow Sub-basin

The LFA includes Nordstrom Creek, Shine Creek, Bones Creek, Ludlow Creek, Piddling Creek, and Little Goose Creek in the Ludlow Sub-basin.

Nordstrom Creek has good connectivity with its floodplain, and the floodplain habitat is good. However, mass wasting associated with logging in the upper watershed has increased the sediment load in the creek. Two culverts currently impede fish access to Nordstrom Creek: one is a perched culvert on the mainstem that is a problem during certain flows, and the other is on a right bank tributary in the upper watershed. The LFA recommends addressing the mass wasting issues and replacing the two culverts in this watershed.

On Shine Creek, a triple culvert at its mouth is a velocity barrier for adult and juvenile salmon migration at certain flows, and also inhibits estuary function. However, the lower reaches of the creek still have access to the floodplain, which has a large wetland complex that provides significant rearing habitat. Lots of large wood remains in the lower reaches of the creek, although much of it is still alive so it does not strictly meet the definition of large woody debris. It does, however, provide significant channel complexity and resting and hiding places for rearing juvenile coho.

Problems in Shine Creek include restricted estuarine function due to the triple culvert, stormwater runoff and associated siltation of a right bank tributary along the south side of SR 104, and presence of reed canary grass and Himalayan blackberry. The LFA recommends working to rectify these problems. In addition, a golf course in the upper reaches of Shine Creek has contributed to the loss of headwater wetlands and floodplain habitat, and has dredged and altered the stream channel. The LFA recommends working with the golf course management to implement best management practices.

Very little is known about habitat conditions in Bones Creek. There is a partial fish passage barrier at Shine Road, and five total barriers upstream. On the south embankment of SR 104, stormwater runoff causes erosion problems. The tidally influenced portion of the lower watershed has been channelized and armored, leading to the complete loss of estuarine function. The LFA recommends addressing the fish access and erosion problems and conducting studies to learn more about habitat conditions in Bones Creek.

Ludlow Creek has an intact floodplain in its lower reaches, with good habitat, stable banks, and good riparian conditions. However, a culvert inhibits estuary function, and a right bank tributary carries stormwater and associated debris from an upstream development, and is a chronic erosion and slope failure problem. In the upper watershed, riparian conditions are fair: around logging operations buffers are minimal, and agricultural practices north of Larson Lake Road have degraded buffers as well. A number of culverts in the upper watershed present total and partial barriers to fish passage along public roads; culverts on private roads have not been inventoried. To address these problems, the LFA recommends expanding the culvert that hinders estuarine function, repairing the sedimentation problem in the right bank tributary in the lower watershed, and creating functional riparian zones and removing the fish passage barriers in the upper watershed. The report also advises conducting ambient monitoring and benthic invertebrate studies.

Very little is known about habitat conditions on Piddling Creek. A perched culvert at Oak Bay Road blocks fish passage to the upper watershed, and two additional barriers are upstream of that culvert. Floodplain connectivity and habitat are poor due to constriction of the creek between driveways. The estuary has been highly modified: the original wetland complex has been channelized and armored. The LFA recommends rectifying the fish passage barrier at Oak Bay Road, and conducting studies to better understand fish production potential in the watershed.

Like Piddling Creek, little is known about habitat conditions in Little Goose Creek. There are culverts in the lower watershed that allow fish passage, but a center standpipe blocks access to a manmade pond. Coho spawn in the creek up to this barrier. The lower watershed has been channelized, armored, and developed for residential use. Although some habitat restoration has occurred in the lower watershed, access to the floodplain has been eliminated. Historically, Little Goose Creek emptied into Little Oak Bay Lagoon, which in turn emptied into Port Townsend Bay. The creek currently empties directly into Oak Bay without any estuary, and fish can enter the creek only at high tide.

There is local interest in reconnecting Little Goose Creek with its historical estuary, and a bulkhead constricting the mouth of the creek and infringing on shoreline habitat has been removed. Landowners also have planted native conifers in the deciduous riparian corridor.

To build upon these efforts, the LFA recommends reconnecting the creek with its historical estuary, connecting the creek to the manmade pond and upper watershed, and conducting habitat surveys in Little Goose Creek.

3.4.2.5 Chimacum Sub-basin

The LFA includes Chimacum Creek and the following tributaries in this sub-basin: East Fork Chimacum Creek, Putaansuu Creek, Naylor Creek, and South Fork Chimacum Creek, which is also known as Barnhouse Creek. The Chimacum Creek mainstem provides primarily rearing habitat, while the numerous spring-fed tributaries are important spawning areas.

The entire sub-basin, with the exception of Chimacum Creek above river mile 9.4, has good fish access. The lower reaches of Chimacum Creek also have good floodplain habitat and connectivity, riparian conditions, stable banks, and little mass wasting. However, conditions in the rest of the sub-basin are fair to poor. Riparian conditions are poor, floodplain connectivity is poor (although it varies in Barnhouse Creek), and large woody debris, pool frequency, and pool quality are poor. Numerous data gaps exist in this sub-basin, especially on the upper reaches of Chimacum Creek, Naylor Creek, and Barnhouse Creek.

A variety of agencies, including the Jefferson County Conservation District, the Port Gamble S'Klallam Tribe, Wild Olympic Salmon, the Quilcene/Snow Restoration Team and the North Olympic Salmon Coalition, have been working with willing landowners in the watershed over the past two decades to restore habitat structure, complexity, and riparian zones.

The Chimacum Creek estuary is narrow, and is near the southwest corner of Port Townsend Bay. The nearshore habitat associated with the estuary is highly degraded because it and the lower estuary were filled for use as a log storage site. The Washington Department of Fish and Wildlife purchased this site and plans to remove the fill and replace it with sandy marine sediment that will be available to nourish nearshore habitats such as the estuary spit. The Chumsortium has preserved much of the lower watershed, including the estuary, through acquisition and conservation easements.

The LFA contains many recommendations to address the problems in the Chimacum Sub-basin. The report recommends restoring natural riverine function through recreating sinuosity, revegetating riparian areas, restoring complexity, repairing wetlands and beaver ponds, controlling reed canary grass, correcting fish passage barriers, and maintaining plantings and fencing. In the estuary, it recommends restoring the tidal delta, estuary, and nearshore habitats by removing fill, and studying rearing conditions in the estuary. The report further recommends protecting high quality habitat in the watershed through outright acquisition or easements, and monitoring water quality and habitat conditions. Lastly, the LFA recommends placing a stream gauge below Chimacum to monitor the effects of urbanization on flow, and assessing surface and groundwater withdrawals to determine their effects on summer low flows.

3.4.2.6 Discovery Bay Sub-basin

According to the LFA, this sub-basin includes Snow Creek, Andrews Creek, Salmon Creek, Contractor's Creek, and Eagle Creek.

Snow Creek originally flowed through the valley as a right bank tributary to Salmon Creek, but was moved to the east side of the valley and now drains directly to Discovery Bay. Although access to Snow Creek is good and sediment supply and dissolved oxygen in the lower creek are good, the remaining habitat conditions in the creek are fair to poor. Because the Snow Creek estuary is artificial, bounded by dikes and fill, and dissected by a railroad grade, it does not function properly.

The LFA recommends actions to address these problems, including restoring estuarine function and natural river functions, protecting high quality habitat through acquisition or conservation easements, and assessing, stabilizing, and monitoring sediment sources to the creek.

Andrews Creek is a tributary to Snow Creek. Little is known about Andrews Creek, although access to its lower reaches is good and it does not suffer from mass wasting or problems with its sediment supply. However, its riparian conditions are poor, and it is disconnected from its floodplain. Like Snow Creek, Andrews Creek could benefit from restoration of riverine functions, establishment of riparian zones, and additional studies to assess and repair excessive fine sediment sources, scour and deposition, and flows.

Fish access to Salmon Creek is good, as is dissolved oxygen in the lower reaches and bank stability in the upper reaches. However, all other habitat conditions for which information is available were fair to poor prior to 2003 (Jefferson County Conservation District, 2003). Over half of the lower watershed has been channelized, and some of the channel has been rip-rapped. Agricultural and grazing practices have severely reduced channel sinuosity, habitat complexity, and riparian buffers. In the upper watershed, a tributary called Houck Creek experienced mass wasting events as the result of a stream diversion over 40 years ago until it was stabilized in 2002 (Jefferson County Conservation District, 2003).

The Salmon Creek estuary is a beach that has abundant sediment sources, but upstream modifications to the creek and the railroad bed's truncation of tidal channels restrict the estuary's ability to function properly.

Cattle fencing bars livestock from the stream except for a well established ford at approximately river mile 0.4. In 2003 the Washington State Department of Fish & Wildlife purchased a 100-acre farm in the lower reach of Salmon & Snow Creeks and, with assistance from the Jefferson County Conservation District and North Olympic Salmon Coalition, implemented Phase 1 of a project to restore floodplain connectivity, sinuosity and complexity in the lower watershed (Jefferson County Conservation District, 2003). Funding is also available to acquire critical habitats in the lower watershed and estuary for protection.

The LFA recommends protecting high quality habitat in Salmon Creek through acquisition or conservation easements, restoring riverine functions, and re-establishing the functional link between the stream and its estuary.

Little is known about Contractor's Creek. However, the LFA identifies two culverts as prominent limiting factors to salmon production in this creek. One culvert, within 50 feet of the mouth of the stream, is greater than 100 feet long and is a barrier at certain flows. The culvert has failed, and a new fall has developed about a quarter-mile upstream as a result of a large slide and culvert failure event in 1996. A new bridge has replaced the failed culvert, but the culvert is still in place. Another culvert upstream at Highway 101 is still passable, but requires maintenance to prevent failure.

Channel modifications and residential development have reduced floodplain connectivity in Contractor's Creek, and the original delta fan eroded after the stream mouth was moved to the south and the culvert placed. A 15-acre salt marsh historically present on the spit in the estuary has disappeared because shoreline armoring cut off its sediment supply. To address some of these problems, the LFA recommends maintaining the culvert at Highway 101, removing the culvert at the mouth of Contractor's Creek, adding large woody debris to the stream to increase habitat complexity, and creating a riparian buffer zone with native conifers.

Like Contractor's Creek, little is known about habitat conditions in Eagle Creek. However, the creek has a bar-bound estuary, which means that there is a natural bar that prevents anadromous fish access to the stream except at high flows. Below Highway 101, two manmade ponds dam the stream and dry it up at approximately river mile 1.0, presenting a barrier to migratory fish. In the lowest part of the stream where water flows, floodplain habitat is marginal. Above Highway 101, habitat conditions are unknown. The LFA recommends the following actions for Eagle Creek: restore stream sinuosity and complexity between Highway 101 and the free-flowing forested stream, and restore flows from the managed pond system.

3.4.2.7 Sequim Bay Sub-basin

The LFA includes Chicken Coop Creek, Jimmycomelately Creek, Dean Creek, and Johnson Creek in the Sequim Bay Sub-basin.

Chicken Coop Creek suffers from five fish passage barriers. Two are water diversions, and three are culverts that are total fish passage barriers. The culvert at Highway 101 is scheduled for repair, and if the Chicken Coop Road barrier upstream also is repaired, these actions will open up over 3,000 square meters of fish habitat.

Below East Sequim Bay Road, the floodplain is a forested wetland/wet meadow complex that provides good fish habitat. Above the road, however, non-invasive plants that hold no potential for future large woody debris recruitment dominate the riparian zone. Currently there is no large woody debris in the stream between the mouth and Chicken Coop Road.

To address these problems, the LFA recommends replacing four of the culverts, adding large woody debris to the stream, and planting the riparian zone with native species to provide cover and large woody debris recruitment.

Jimmycomelately Creek was moved from its original channel to the east side of its valley. It also has been channelized, diked, straightened, and armored, and its estuary filled to reclaim land for log storage operations. Logging, railroad construction, wetland filling, diking, native vegetation removal, and residential, agricultural and commercial development have taken their toll on Jimmycomelately Creek, resulting in cutting the stream off from its floodplain and eliminating wetlands, riverine, and estuarine habitats.

Efforts are well underway to restore the creek to its original channel, and environmental groups are monitoring water quality in the creek. To build upon these actions, the LFA recommends removing fill, contaminated sediment, roads, and pilings from the estuary; turning an abandoned trailer park into a salt marsh; constructing tidal channels; moving the creek back to its original location, building a bridge, and planting a riparian zone; removing delta cone accretion to regain intertidal habitat; replacing the trestle with a walking bridge; planting the riparian zone with conifers below the cascade; conducting a culvert assessment; and installing cattle exclusion fences and riparian plantings in the upper watershed.

Like Jimmycomelately Creek, the Dean Creek estuary was filled to create a log yard. Between the estuary and river mile 0.5, the creek was channelized and its banks armored. As a result of the development of

parking lots and logging operations, floodplain habitat, including wetlands, riparian areas, and stream sinuosity and complexity, has been lost. To restore some of these functions, the LFA recommends removing the fill from the estuary, and adding sinuosity to the creek below Highway 101. Some of these improvements are underway as part of the Jimmycomelately estuary restoration project (Soule, 2003).

Johnson Creek has good fish access: there are no culverts on the stream. However, the lower portion of the watershed has been developed, and the stream has been channelized and heavily armored. Downstream of Highway 101, a trailer park and marina have cut the stream off from its floodplain and eliminated sinuosity and instream structure. Above Highway 101, the riparian condition is good, but below the highway there are no riparian buffers at all. Like the lower reaches of the stream, the estuary has been channelized and armored, and has lost all estuarine function. The LFA recommends establishing a riparian zone in the lower part of the watershed, adjacent to the trailer court.

3.4.2.8 Nearshore Sub-basin

The marine nearshore is an important habitat for salmonids. It provides a migratory corridor for both adults and juveniles, but it also is a nursery habitat for juveniles. In nearshore habitats such as salt marshes, eelgrass beds, and mudflats, juvenile salmonids can rest, hide from predators, and eat enough to grow large enough to migrate to the ocean. These habitats are crucial to the success of salmon recovery in Puget Sound, but have been diked, filled, armored, and polluted over time.

The LFA discusses each segment of the WRIA 17 nearshore in detail. In the sub-basin summaries above, information about each estuary was provided, so this information will not be summarized here again. Instead, major stressors to the nearshore environment and the highest priority projects to address these stressors are summarized below.

The LFA contains a table of nearshore stressors, and the effects they have on nearshore habitats and species. These stressors include shoreline armoring such as riprap and bulkheads, overwater structures such as docks and piers, ramps, stormwater and wastewater discharges, landfill below the higher high water line, and loss of riparian habitat.

Shoreline armoring has a suite of adverse effects on nearshore habitats, processes, and species. Armoring fills nearshore habitats, and cuts off the sediment supply that naturally comes from eroding bluffs, banks, and beaches. As a result, sediment offshore gradually becomes coarser, and can become too coarse to support important nearshore plants such as eelgrass. It also increases scouring of sediments in front of armoring installations, leading to a loss of the shallow habitats that juvenile salmon depend upon as refuge from predators.

Overwater structures also interfere with sediment supplies, and can shade out important nearshore plants such as eelgrass. Juvenile salmon also do not like the dark places under docks and piers, so they are forced out into deeper water where they are more susceptible to predation. Boat ramps interrupt sediment supplies and migration routes.

Stormwater and wastewater discharges to the nearshore environment have a range of adverse effects on the habitats and species there, including decreasing dissolved oxygen, increasing contaminant and nutrient loads, scouring sediments, and changing the way freshwater and saltwater interact. These changes degrade or destroy habitat, place species at higher risk of disease or death, and reduce the amount of prey available.

Historically, many coastal wetlands such as salt marshes or tidal wetlands were filled for development ranging from agriculture to logging operations to residential and commercial uses. Filling destroys

habitats that are important nurseries for juvenile salmon and other species, alters the communities of plants and animals in the nearshore, and eliminates shallow habitats.

Lastly, riparian plants historically have been removed from the nearshore to make way for development, as part of logging operations, or to improve views. Marine riparian areas are important because they provide shade to estuaries, are a source of food, and trap pollutants that might otherwise make their way into the nearshore.

As part of the process of developing the LFA, the Technical Advisory Group prioritized nearshore protection and restoration ideas based on their proximity to priority watersheds, and the spatial, ecological, and temporal scales that they address. Many of the highest ranked projects involved removing fill, replacing culverts, removing dikes, and restoring sinuosity in estuaries. These projects would allow nearshore processes to function naturally. In addition to the specific project recommendations, the group made the following basin-wide general recommendations:

- Protect naturally eroding bluffs
- Remove intertidal fill
- Protect estuaries
- Treat stormwater and wastewater properly
- Protect and/or restore salt marsh habitat
- Remove unused creosote pilings

These recommendations should help Planning Unit members, citizen groups, and resource agencies develop restoration actions or make policy decisions.

Chapter 4: Options

Options

This chapter presents a wide variety of options for addressing water quantity, water quality, and habitat in WRIA 17.

4.1 Options to Increase Water Supplies and Reduce Water Consumption

The Planning Unit recognizes the need to plan for future water use by finding a balance between beneficial uses (including growth), economic development and habitat. The following opportunities are possible ways to accomplish this balance. The Planning Unit will not explore any options that would in any way interfere or jeopardize an existing water right.

4.1.1 Options for Involving the Public

4.1.1.1 Establish incentive-based water conservation programs through water purveyors

Problem Statement

Water conservation is an important tool for preserving instream flows, maintaining aquatic habitat, and ensuring the health of aquifers. When citizens and businesses pay low prices for water, there is little financial incentive for them to use less water.

Description of Option

In the 2003 Special Session, the Washington State Legislature adopted 2E2SHB 1338, which requires all municipal water systems to establish water conservation programs. The legislation also requires the Department of Health to establish standards for these programs by December 31, 2005. One option for water purveyors in WRIA 17 is to create incentive-based water conservation programs, which are a common and effective means of changing customer water use patterns. Consumers respond to price, and so incentives to either dissuade high water use or encourage water conservation are likely to be effective. For example, rate structures that charge for the amount of water used, and charge a higher rate for consumption above a certain level or during a certain period of time encourage customers to use water efficiently.

Following are several options for incentives for efficient water use:

- **Tiered rate structures** have a per-unit charge that increases as water consumption increases. For example, a customer could be charged a certain rate for each cubic foot of water up to a certain threshold (such as 250 gallons per day), and another, higher rate, above that threshold.
- **Summer surcharges** include an additional charge for water use above a certain threshold during months when system demand is highest. The City of Port Townsend formerly had such a surcharge in place.
- **Rebates on water-efficient appliances, especially toilets,** help make low-flow appliances more appealing, and even desirable. For example, a town on Whidbey Island offered $200 rebates on ultra

low-flush toilets, and received a tremendous response. According to the mayor of Coupeville, this positive response stemmed from residents' perception that the town was participating in the solution to their water supply problem (Washington Department of Health, date unknown).

Rationale

Sending consumers price signals is one means of encouraging preferred, conservation behaviors. Because citizens can take simple, often painless steps to conserve water, this strategy is a cost-effective way to increase effective water supply.

Potential Implementers

The Jefferson County PUD #1 and the City of Port Townsend would be prime implementers for these incentives. Incentive programs would need to be compared to the Department of Health's standards in 2005.

Recommendation: Prepare and implement water conservation plans

The Planning Unit recommends that water purveyors and major water users in the WRIA prepare and implement water conservation plans. Incentive-based water conservation programs should be considered in the plans. Examples of incentive-based conservation programs include tiered rate structures, summer surcharges, rebates on water-efficient appliances—especially toilets, and offers of free or discounted water-saving devices, such as low-flow shower heads. Water conservation plans should also include education and outreach programs.

4.1.1.2 Establish Water Conservation Programs for Rural Residents on Individual Wells

Problem Statement

A variety of incentives are available to water purveyors to help decrease their customers' water use, as described above. However, introducing incentives or other programs for rural users on individual wells is an entirely different challenge. Without the rate structures and regular communication (via bills) available to water purveyors, other strategies must be employed.

Description of Option

Very little information is available about water conservation programs aimed at well users in other jurisdictions. Most jurisdictions seem to rely on countywide education programs, especially school programs or websites, to educate well users about water conservation. However, the Clearwater Underground Water Conservation District in Bell County, Texas, offers programs aimed at well users only. This District, created through a popular vote and funded through ad valorem taxes, has developed water conservation packets that are distributed through schools, and has speakers available to give presentations to community or school groups (Clearwater Underground Water Conservation District, 2003). The District's Management Plan also calls for distributing public education materials, and developing secondary-school education programs such as contests focused on demonstrations of water conservation practices (Clearwater Underground Water Conservation District, 2000).

Following are several options for programs to promote and implement voluntary water conservation. Most of these options would apply to both customers of public water systems as well as rural residents on individual wells, although strategies could be focused specifically on rural residents.

- **Education and outreach** programs, especially when standardized and broad-based, would help encourage conservation. For example, a countywide education effort stressing water conservation

and offering practical solutions could apply to both customers of public water systems as well as rural residents on individual wells. Some possible themes to consider would include low-water use gardening and lawn care practices, and use of water-efficient appliances and fixtures. See option 4.1.1.3 for more on increasing public awareness and education on water use.

- **Rebates on water-efficient appliances, especially toilets,** are incentives that apply to all water users, both customers of public water systems as well as rural residents on individual wells.
- **Other free or discounted water-saving products** could include faucet diffusers, low-flow showerheads, rain gauges, soaker hoses, hose timers, and other water-saving devices.
- **Community-based social marketing** is based on the idea that education and economic incentives, as discussed above, are in themselves often insufficient to actually motivate widespread behavior change and produce measurable results. In general, community-based social marketing is a strategy in which (1) barriers and benefits to behavior change are identified; (2) a strategy is designed that utilizes behavior change tools; (3) the strategy is piloted with a small segment of the community, and (4) the strategy is implemented in the large community and evaluated. Behavior-change tools used in community-based social marketing often include personal contact, and gaining commitments from individuals that they will try a new activity. Following are some specific water-conservation strategies suggested by Doug McKenzie-Mohr and William Smith, two pioneers of community-based social marketing, in their book *Fostering Sustainable Behavior* (1999):
    - To encourage lawn watering on odd or even days, ask each homeowner for permission to place a tag on the outside water faucet.
    - Arrange with local retailers to attach decals to lawnmowers that encourage householders to raise the level of the lawnmower, thereby fostering a lawn that needs less water.
    - Have homeowners place an empty tuna can in the yard to measure adequate watering. When the can is filled with water the garden or lawn has been adequately watered.
    - Attach decals to dishwashers and washing machines in retail stores encouraging full loads.
    - Attach decals to low-flow toilets and showerheads indicating that they save water and money.

  Although most strategies could apply to all residents, potential implementers of these or other strategies could focus their efforts more specifically on rural residents, if needed.

Rationale

Residents need information, incentives, and, in some cases, personal reminders and commitments to voluntarily implement water conservation measures. Because typical financial incentives are not available for rural residents, and Washington's water law allows up to 5,000 gallons per day per well, creative strategies are needed to encourage water conservation among rural residents.

Potential Implementers

Jefferson County would be an appropriate lead for any countywide education and promotion effort. Other incentives and programs could be accomplished at the City or County level. Other organizations would be excellent partners. For example, the Jefferson County Conservation District has established good relationships with farmers and other rural citizens. Because these citizens trust the Conservation District, the District would be a logical organization to lead or partner in rural education efforts.

Recommendation

This option is included in the recommendation under option 4.1.1.3 (Increase Public Awareness and Education on Water Use).

4.1.1.3 Increase Public Awareness And Education On Water Use

Problem Statement

The above programs to reduce water consumption rely upon water users to implement conservation practices. But for individual residents or businesses to take action, they must first understand the problem and their possible roles in creating a solution.

Description of Option

A variety of means exist to communicate with the public. Notable strategies include:

- **Chart individual water use in utility bills.** Clearly informing ratepayers of their monthly water use, especially through simple time-series charts, is an easy means of motivating change. For comparison, bills can also display the average water consumption of all customers in a certain class, such as single-family households. However, this strategy would not apply to rural households on individual wells.
- **Launch education and promotion campaign.** Education and promotion campaigns have been very successful at communicating the need to conserve, motivating behavior change, and offering water-saving practices. Utility bill inserts, direct mail, newspaper articles, billboard ads, and other forms of promotion could be implemented. Information could be included on water-saving practices, especially related to lawn and garden care. As an example, education and promotion strategies have been very effective in Seattle, particularly when they have been necessitated by summer drought forecasts.

Rationale

As stated above, in order to achieve water conservation goals, water users must understand the problems associated with elevated water consumption, be motivated to take action, and understand possible actions.

Potential Implementers

The City of Port Townsend, Jefferson County, the Jefferson County Conservation District, the Public Utility District, the tribes, the Water Utility Coordinating Council, the Washington State Department of Ecology, and the Home Builders Association, and the environmental non-profits on the Planning Unit would be logical partners in a water conservation education program.

Recommendation: Increase public awareness and education on water use

The Planning Unit recommends that all Planning Unit members collaborate to develop public education programs about water use. Two examples of strategies include charting individual water use on utility bills, and launching an education and promotion campaign.

4.1.2 POLICY AND PLANNING OPTIONS

4.1.2.1 Support Implementation of Existing Water Conservation Plans and Updates

Problem Statement

Under WAC 249-290-100, the Washington State Department of Health requires a comprehensive water system plan, which includes a conservation component, of all water systems with 1000 or more service

connections. A plan is also required of all new or expanding systems of 15 or more service connections. The plan for systems of 1000 or more connections is to be updated every six years. Conservation plans prepared in accordance with Conservation Planning Requirements will be reviewed and approved by the Department of Health, with concurrence from the Department of Ecology.

Description of Option

The Department of Health (DOH) requires all water conservation plans to include an analysis of the costs and benefits of installing individual service meters and implementing conservation rate structures, and to plan for yearly program promotion. As these requirements clearly relate to water supply and hence to watershed planning, other agencies involved in the planning process could lend support to the Jefferson County Public Utility District #1, City of Port Townsend, and other purveyors to ensure that the water system conservation planning process is aligned with the watershed planning process, and that it is successfully implemented. This support could first come through staff time to assist with establishing conservation objectives and evaluating conservation measures in the plan, and through follow-up financial, in-kind, and/or political support of measures to be implemented. In particular, a team of several agencies could implement a combined education and outreach and conservation program, of which several options were discussed above.

Rationale

Water system conservation planning is required by the Department of Health. Since conservation is an integral component of watershed planning, the periodic conservation plans, annual promotion components, and implementation of conservation measures could be carried out with support from various agencies involved in watershed planning.

Potential Implementers

In addition to the PUD, City of Port Townsend, and other purveyors responsible for conservation planning, other Planning Unit members could lend support. For example, the City of Port Townsend, Jefferson County, the Jefferson County Conservation District, the tribes, the Water Utility Coordinating Council, the Washington State Department of Ecology, and the Home Builders Association, and the environmental non-profits on the Planning Unit would be logical partners in a water conservation program.

Recommendation: Prepare and implement water conservation plans

The Planning Unit recommends that water purveyors and major water users in the WRIA prepare and implement water conservation plans. Incentive-based water conservation programs should be considered in the plans. Examples of incentive-based conservation programs include tiered rate structures, summer surcharges, rebates on water-efficient appliances—especially toilets, and offers of free or discounted water-saving devices, such as low-flow shower heads. Water conservation plans should also include education and outreach programs.

4.1.2.2 Support the City's Drought Contingency Planning

Problem Statement

As discussed above, the Department of Health requires comprehensive water system plans to be updated every six years. As part of this requirement, water systems that experience a water shortage, or anticipate a water shortage within the next six-year planning period, are required to submit a water shortage response plan. This process can also be called *drought contingency planning*. In 2001, the City of Port Townsend concluded that it is highly susceptible to drought, due to reliance on rainfall-dependant surface water supplies.

Description of Option

Given its susceptibility to drought, the City of Port Townsend must plan for water shortages. In particular, it must actively focus on conservation, and on determining whether an additional water supply should be identified for drought emergencies. Planning assistance could be provided to the City for this process. This support could come through staff time to assist with identification and evaluation of options for dealing with a water shortage. Financial or staff assistance could also be provided to implement measures of the water shortage response plan.

Rationale

While drought contingency planning is a pressing need in Port Townsend due its status as the largest city in WRIA 17, the fundamental problem of water supply is a much larger issue not confined to the City's boundaries. Therefore, the participation of a broader community of organizations would be beneficial.

Potential Implementers

Other planning unit members could lend support, as could Port Townsend Paper, the largest single customer in Port Townsend. Port Townsend Paper has been forced to reduce water usage during drought conditions to conserve water for city residents.

Recommendation: Coordinate regional drought contingency and system security planning

The Planning Unit recommends that water purveyors develop and coordinate drought contingency plans that consider inter-ties and conjunctive use in the event of extreme drought or contamination

4.1.3 REGULATORY OPTIONS

4.1.3.1 Identify Where Existing Laws Constrain Wise Water Use And Promote Changes To These Laws

Problem Statement

Washington water rights are legal authorizations to use public water for specific beneficial purposes. Water rights are required to divert any amount of surface water or to withdraw groundwater in amounts greater than 5000 gallons per day or to irrigate more than one-half acre of lawn or noncommercial garden. Three features of the current Washington water laws may constrain wise water use:

- **Water rights are currently "use it or lose it."** In other words, water rights may be lost if they are unused for a period of five consecutive years (termed "relinquishment") or may be abandoned if the owner of the right shows intent to do so.
- **Single-family wells are exempt from needing a water right if they use less than 5,000 gallons per day.** The 5,000-gallon limit provides little or no incentive for individual well users to conserve.
- **Outdoor watering for residential lawn and garden use are exempt.** This exemption, for irrigation of up to one-half acre, provides no incentive to implement landscaping practices that conserve water.

Description of Option

Changes to the Washington water laws could eliminate the above disincentives to conservation. In particular, the WRIA 17 planning unit could recommend that the State revise RCW 90 to:

- Provide an ongoing mechanism to eliminate disincentives to conservation (i.e., the "use it or lose it" concept), and allow ongoing, orderly transfer of saved water to instream flow needs.

- Reduce the exemption in RCW 90.44.050 for individual residences (and associated outdoor water use) to a more realistic withdrawal volume, such as 500 gallons per day.

Rationale

Data from the technical assessment show that while surface water diversions are a relatively small percentage of the *annual* discharge of the Big Quilcene River, comparison of the *seasonal* flows in the river to the optimum instream flows for salmon species shows that there is not enough water in the river when salmon need it. Likewise, although groundwater withdrawals are less than recharge on an annual basis, users are likely to consume more groundwater in summer, when it is most needed to augment base flows in rivers and streams.

Promoting changes to Washington water law could eliminate current disincentives to conservation, thereby leaving more water in the river for fish and other beneficial uses.

Potential Implementers

The Washington State legislature would ultimately need to implement such changes. However, the WRIA 17 Planning Unit can work to build support for these changes and make recommendations to the legislature.

Recommendation: Identify where existing laws constrain wise water use and promote changes to those laws.

The Planning Unit recommends that its members work to build support for reforming Washington water law so that it promotes wise water use. Examples of potential changes include providing an ongoing mechanism to eliminate disincentives to conservation, allowing orderly transfer of conserved water to instream flow needs or other beneficial uses, allowing water storage from residential rain water catchments, modifying plumbing standards, and reducing the daily withdrawal limit on exempt wells.

4.1.3.2 Enforce Existing Laws and Regulations Regarding Illegal Water Withdrawals

Problem Statement

Although the vast majority of water users withdraw water legally, illegal withdrawal of water does occur in Washington State. Illegal water withdrawals harm Washington residents that depend upon water resources for drinking water supply, and fish and other wildlife.

Description of Option

RCW 90.03 is the Washington water code, which governs surface water withdrawals. RCW 90.44 regulates public ground waters. Both codes describe the legal ways to obtain water rights, and both contain provisions for violation of the codes as follows:

- RCW 90.03.400 states that the unauthorized use of water to which another person is entitled, or the willful or negligent waste of water that harms another person, is a misdemeanor.
- RCW 90.03.410 makes interfering with, destroying, or altering water diversion structures such as dams or weirs a misdemeanor. It also states that destruction, interference, or alteration of structures with the intent to illegally divert water is a misdemeanor.
- RCW 90.44.120 states that the unauthorized use or waste of groundwater is a misdemeanor.

In addition, RCW 90.03.600 allows the Department of Ecology to assess fines of up to $100 per day for each violation.

RCW 90.03.065 sets forth the sequence of enforcement actions. Ecology is required to educate the general public about water law and compliance with water law. If the department notices a violation, it should attempt to achieve voluntary compliance with the law by providing information and technical assistance to the violator. If the violator fails to comply, Ecology may issue a notice of violation and levy fines. However, the code also states that Ecology can take immediate action if the violation is causing harm.

This option calls for improved enforcement of this existing code. Doing so may require increased monitoring of water withdrawals and instream flows, as well as field surveys to find unauthorized diversion structures.

Rationale

Enforcing existing regulations may help to decrease the incidence of violations, thereby preserving the water available for people and for fish. Focusing on existing regulations is a more streamlined approach than attempting to establish new regulations, and likely will win more support among watershed stakeholders. To be most effective, the price of non-compliance must be higher than the price of compliance.

Potential Implementers

The Department of Ecology is charged with enforcing the existing water code. However, Planning Unit members can support these efforts politically, or even financially if desired.

Recommendation: Facilitate compliance with existing laws and regulations regarding illegal water withdrawals.

The Planning Unit recommends that the state legislature fully fund the Department of Ecology's enforcement operations to stop illegal water withdrawals. Ecology should work with Planning Unit members to initiate actions to bring those who are illegally withdrawing water into compliance.

4.1.4 Programs Concerning Land Use and Transfer of Water Rights

4.1.4.1 Participate In Water Rights Acquisition Programs

Problem Statement

WRIA 17 is one of 16 "fish-critical" basins in Washington State. In late summer and early fall, critically low stream flows in WRIA 17 can limit fish survival. Water rights acquisition programs are intended to keep sufficient water in the streams to maintain fish survival.

Description of Option

Water rights acquisition programs work with holders of water rights to voluntary dedicate these rights to maintain instream flow, restore habitat, and improve water quality. Common strategies employed by groups such as Washington Water Trust and now the Washington State Department of Ecology are to provide market incentives for water right holders to leave water in the streams.

In early 2003, the Department of Ecology launched the Washington Water Acquisition Program, a voluntary program to increase stream flows in 16 watersheds (including WRIA 17) with vulnerable salmon and trout populations. Using state and federal funds, program sponsors are providing an opportunity for

farmers, ranchers, paper mills, and other water-right holders to participate in salmon recovery by selling, leasing or donating their water where critically low stream flows limit fish survival.

All water obtained through Ecology's new program will be returned to the creeks, streams and rivers where it was originally withdrawn. Program sponsors have developed criteria and guidance to help ensure water-right acquisitions receive fair market value and are targeted in areas that will most benefit fish.

Water-right holders can participate by:

- Selling all or part of a water right;
- Leasing all or part of a water right; or
- Donating all or part of a water right on a temporary or permanent basis.

Water right holders in WRIA 17 could participate in water rights acquisition programs, including those of the Washington Water Trust and the Department of Ecology. One highly beneficial approach could be to target holders of large water rights, and work with them to reduce water consumption and sell, lease, or donate part of their right.

Rationale

Water rights acquisition programs are a key means of working within the existing water rights structure to dedicate and secure instream flows necessary to maintain habitat and fish survival. Participants in WRIA 17 would receive some priority treatment for outright purchase or other reimbursement due to WRIA 17's listing as a critical basin (Wiatrak, 2003).

Potential Implementers

Owners of individual water rights can directly participate in these largely state-level programs. However, in practice it is often desirable to have a local government partner (such as Jefferson County or the City of Port Townsend) participate by working with large water right holders on water conservation practices and helping them to sell, lease, or donate their water rights.

Recommendation: Participate in water rights acquisition programs.

The Planning Unit recommends that local governments and conservation organizations provide assistance to water-right holders who wish to participate in water-rights acquisition programs on a temporary or permanent basis.

4.1.4.2 Consider Creating a Water Conservancy Board

Problem Statement

Washington water law is complex, and the number of applications for new water rights and water rights adjustments far outpaces the Washington Department of Ecology's ability to process them. Currently, Ecology faces a backlog of approximately 1,900 water-right change applications (Washington Department of Ecology, 2003b), and over 5,000 applications for new water rights. Water law requires water-right applications to be processed in the order in which they are received, and applications for new water rights often precede applications for water-right changes. As a result, Ecology is not able to process water-right change applications in a timely fashion (Washington Department of Ecology, 1999).

Description of Option

A Water Conservancy Board (Conservancy Board) is an independent unit of local government that is established through a resolution of the county or counties that it serves. A Conservancy Board can serve

a single watershed, multiple watersheds, a county, or multiple counties. There are currently 20 Conservancy Boards operating in Washington that serve 16 eastern and 5 western Washington counties.

Water Conservancy Boards may accept and process applications to change or transfer a water right under RCW 90.80. Because Conservancy Boards can process only water-right change applications, they do not need to wait for new water-right applications to be processed before they can address change applications (Washington Department of Ecology, 1999). As a result, they can process change applications much more quickly than Ecology can. However, Ecology reviews all of the Conservancy Board's decisions, so while this process is helpful, it is not a cure.

In Jefferson County, a Conservancy Board could oversee the transfer of water rights under a water rights trust or acquisition program. Currently, only four (4) water-right change applications are pending in Jefferson County.

Rationale

Conservancy Boards can evaluate and process water-right change applications, thereby helping the Department of Ecology reduce its current backlog of applications. This process can be of great benefit to residents and businesses that otherwise may have to wait months or years before Ecology can process their request. It also would likely prove to be of great assistance to water-rights acquisition programs. However, few water-right change applications are pending in Jefferson County.

Potential Implementers

Jefferson County could establish a Conservancy Board through resolution. In addition, the County could partner with Clallam County to establish a Conservancy Board that addressed all of WRIA 17, and potentially WRIA 18 as well.

Recommendation: Do not create a Water Conservancy Board at this time.

The Planning Unit recommends that Jefferson County not create a Water Conservancy Board at this time. If the number of applications for water rights modifications increases significantly in the future, Jefferson County should consider creating a Water Conservancy Board, perhaps in cooperation with Clallam County.

4.1.4.3 Protect Critical Aquifer Recharge Areas and Wellhead Protection Zones.

Problem Statement

Aquifer recharge areas and wellhead protection zones are critical to the quantity and quality of groundwater and the drinking water supply.

Description of Option

The Jefferson County Comprehensive Plan instructs Jefferson County to "protect aquifer recharge areas from depletion of aquifer quantity or degradation of aquifer quality" (Jefferson County, 1998). Although the Plan includes a policy related to land use regulations for septic systems, drainage, and land use practices, other possibilities also exist. In particular, the following options may help protect critical aquifer recharge areas in advance of development, thereby protecting aquifer quantity and quality in a more cost-effective manner:

- **Acquisition of recharge areas.** Although directly purchasing critical areas may be the surest approach to permanent preservation, no community could afford to purchase all such critical areas. Outright purchase could be employed for extremely critical areas, or for those where no other option is

available. Soliciting donations is another option, as tax laws favor donation of open space to government and nonprofit agencies, such as the Jefferson Land Trust.

- **Acquisition of development rights to recharge areas.** Development rights are somewhat less expensive than acquiring the full title to a property, but still provide permanent protection. Jefferson County Conservation Futures is dedicated to purchasing or otherwise acquiring development rights to sensitive areas. Transfer of development rights can also be accomplished through conservation easements to a group such as Jefferson Land Trust.
- **Tax incentives.** Solutions such as acquiring property titles or development rights are compelling because of their permanence. Still, some other non-regulatory options are available when existing landowners do not wish to give up any rights. For example, the public benefit rating system allows for parcels to be assessed property taxes at rates corresponding to their "current use" rather than the typical "highest and best use" classification. Forested or open-space land in an aquifer recharge zone or wellhead protection area could thereby qualify for greatly reduced property taxes.
- **Zoning regulations.** These ordinances can be crafted to allow only low-impact or low-density development where open space is needed to protect critical areas, such as aquifer recharge areas. Subdivision and clustering ordinances can require or encourage property owners to set aside a certain amount of open space for public or private use.

Rationale

Maintaining pervious land in aquifer recharge areas and wellhead protection zones is critical to maintaining groundwater quantity.

Potential Implementers

Jefferson County, the Jefferson County PUD, or Jefferson Land Trust would be well suited to acquisition of property titles or rights. Jefferson County reviews open space applications in the County, and could therefore assist with application of property tax incentives. Jefferson County would also be best suited to review or revise zoning regulations.

Recommendation: Protect critical aquifer recharge areas and wellhead protection zones.

The Planning Unit recommends that Jefferson County define and delineate aquifer recharge areas and wellhead protection zones. Jefferson County extends property tax incentives to landowners who leave these areas forested or undeveloped. Jefferson County should regularly update zoning and development regulations to ensure these areas are protected. Water purveyors, Jefferson County, or Jefferson Land Trust could acquire property titles or development rights to these areas.

4.1.5 Options to Improve Information

4.1.5.1 Better Implement Water-Metering and Reporting Requirements in the WRIA

Problem Statement

In 1993, the Washington Legislature passed a law (RCW 90.03.360) requiring those who make significant surface and groundwater withdrawals to meter their use. However, because Ecology was not successfully implementing this requirement, a new rule (Chapter 173-173 WAC) was put in place in January 2002 that added several clarifications, as well as metering and reporting requirements.

Description of Option

Under the new rule, Ecology has sent out orders to water users comprising the top 80% of total water use in the 16 fish critical watersheds, including WRIA 17. These users will now be required to meter their water use and report to Ecology. Some funding is available to help with installation of metering equipment.

Large water users in WRIA 17, if issued an order, should therefore start metering and reporting their water use. To encourage better metering and reporting, the WRIA 17 Planning Unit could identify the large water users in the watershed, and offer them technical assistance or other support.

Rationale

The goal of improving water-metering and reporting requirements is to ensure the reliable, accurate measurement of water that is diverted, withdrawn, stored and used so that sound decisions may be made in administering state water laws and regulations.

Potential Implementers

The Washington State Department of Ecology has begun implementing the revised rule. Individual water users will need to begin metering and reporting, if they are not already doing so. Planning Unit members could assist Ecology by providing technical assistance or other support to comply with the metering and reporting rules.

Recommendation: Better implement water-metering and reporting requirements in the WRIA.

The Planning Unit recommends that Planning Unit members assist the Washington Department of Ecology with implementing water metering and reporting requirements. This assistance could take the form of technical assistance or other support.

4.1.5.2 Other Options to Improve and Expand Existing Information and Data Gathering

Problem Statement

Large quantities of information already available, such as that collected and presented in the WRIA 17 Technical Assessment, have and will continue to be invaluable to planning for water supply and watershed health. Still, some additional information could be useful to plan for emerging issues such as climate change or opportunities such as artificial aquifer recharge or conservation. This section describes several options for improved or expanded information, data gathering, or new studies.

Description of Option

Several possible new studies could be conducted:

- **Prepare water supply forecasts based upon regional climate change models.** Initial research by the University of Washington suggests that climate change will have a significant impact on water supply in Western Washington within 20-40 years. For example, their modeling of the effects of climate change on the Cedar, Tolt, Green, and Sultan watersheds predicts an average 20% decrease in spring flows by 2020 and an average 31% decrease in spring flows by 2040 (Palmer and Miller, 2003). Application of similar models could help planners compare projected demand with future supply.
- **Develop a computer model that simulates the hydrogeologic conditions in critical areas of the WRIA** (e.g. the Chimacum basin). A model could be used to simulate the effects of future water use, possible drought conditions as exacerbated by climate change, development and growth, and

potential seawater intrusion on water supply in critical areas of WRIA 17. Such a model would allow planners to consider the range of possible future scenarios and plan accordingly.

- **Conduct an artificial aquifer recharge and recovery feasibility study.** Artificial aquifer recharge refers to the injection of water into underground water-bearing strata (the aquifer) where it may be stored for future use. Such recharge may be conducted for ground water resource management, water storage and recovery, prevention of saltwater intrusion into freshwater aquifers, and subsidence control, among other purposes. A study of the feasibility of water storage in artificial aquifers and recovery for beneficial use could be conducted to evaluate its potential as a tool for water resources management. As part of the WRIA 17 Planning Unit's storage study, a brief and cursory assessment of aquifer storage was conducted, but no obvious site was identified. However, a more thorough feasibility analysis would need to be conducted before the conclusion is certain.
- **Complete a Dabob Bay hydrogeologic characterization.** Such a characterization would provide additional information about hydraulic continuity in this basin. This information would assist efforts to allocate and protect surface and groundwater in the basin.
- **Prepare a comprehensive water conservation assessment to maximize cost-effective water conservation in the WRIA**. Given the need to implement water conservation measures with many different types of users, and the many different organizations charged with implementing such measures, a comprehensive assessment of water conservation could help identify opportunities for coordination, eliminate areas of overlap, target effective practices, and generally maximize the cost-effectiveness of water conservation programs.
- **Determine actual water use.** Chapter 3 of this plan presents data from the Technical Assessment on groundwater use, and compares that information to water rights and claims and estimated groundwater recharge. Still, actual water use by most users, even those with water rights, is unknown. Although the Department of Ecology will now be requiring top water users (those holding the top water rights, claims, or certificates amounting to 80% of all use) to monitor and report their water use, actual use for single domestic wells will in most cases still be unknown. Understanding actual water use would allow better planning for water supply and better targeting of water conservation programs.

Rationale

New studies will be necessary to take advantage of new conservation opportunities and plan for emerging issues.

Potential Implementers

Given the wide variety of studies discussed above, a wide variety of organizations could be involved.

Recommendation: Improve the sharing of existing information and data gathering.

The Planning Unit recommends that its member organizations and other interested parties improve and expand existing information and data gathering efforts.

4.2 Options for Water Quality Protection and Enhancement

4.2.1 Options for Funding Surface Water Management Activities

4.2.1.1 Create a Surface Water Management District

Problem Statement

One of the most pressing needs in WRIA 17 is acquiring funds to improve and protect water quality, especially through education, technical assistance, infrastructure improvement, and enforcement of existing water quality regulations. A surface water management district is a type of government that, if established, could assess fees and coordinate surface water management in unincorporated Jefferson County.

Description of Option

A surface water management district is an example of a government entity called a "special purpose district." Special purpose districts are political subdivisions of Washington State other than counties, cities, towns, or townships. As authorized by the Washington legislature, special purpose districts carry out specific, limited functions for residents of, and any other persons served by, the district. Fire protection districts and school districts are common examples of special purpose districts. Districts that focus on surface and storm waters can be established under a variety of laws in Washington, especially RCW 36.89, RCW 57, and RCW 85. A related option would be to establish an Aquifer Protection District under RCW 36.36.

Surface water management districts are fairly common in Western Washington, especially in urban or suburban regions with significant or growing development. Currently, there is one surface water management district in Jefferson County, in the North Bay area of Port Ludlow. The City of Port Townsend also collects a utilities fee for stormwater management (City of Port Townsend, 2003). Skagit, Snohomish, King, Pierce, Thurston, and Clark Counties all have some form of surface water management district, as do several of the cities within these counties. Such districts are less common in more rural areas. However, Kitsap County has established a district, an action that some believe will help to pro-actively manage, or even prevent, the type of water quality impacts seen in the more urban counties cited above. In unincorporated Jefferson County, a surface water management district could focus on the potential development impacts in the Chimacum Creek and Ludlow Creek basins.

Surface water management districts typically raise funds by assessing fees on residential, commercial, government, and in some cases agricultural properties. Fees are generally assessed based on the amount of impervious surface contained within the property. A standard fee is typically assigned to all residential parcels, based on the average impervious surface of all residential parcels in the district; fees for commercial properties are then assessed based on multiples of the residential fee. For example, the $45 annual residential fee in Kitsap County is based on 4200 square feet of impervious surface per parcel. Non-residential parcels are then assessed in $45 increments based on how many "equivalent residential units" of 4200 square feet they contain.

Rationale for Pursuing Option

The establishment of a surface water management district in unincorporated Jefferson County would raise valuable fees that could be used to support a variety of projects, programs, and/or enforcement activities focused on water quality and non-point pollution. This funding source is both stable and equitable. The Kitsap Surface and Stormwater Management District uses its annual $4.4 million to fund the following efforts carried out within four agencies, shown in Table 5.

Table 5: Sample Activities Supported by a Surface Water Management District (from Kitsap County, Dickson, 2003)

Department of Public Works	Conservation District
• 2 Water Quality Tech Staff for compliance and enforcement • 1 Education and Outreach Coordinator • 1 Geographic Information System Specialist • Operations and Maintenance of stormwater infrastructure • Capital construction, conveyance, and flood control projects • Fish Ladder	• Planning, implementing, enhancing agricultural programs to implement best management practices • 1 technical staff in each county commissioner's district
County Health District	**Community Development**
• Septic monitoring and maintenance • Surveying wellhead connections for Group B wells	• Awarding of small grants for repair/restoration • 1 Stream Team staff to assist small grants • 0.5 staff on salmon education

Potential Implementers

Based on experience elsewhere, Jefferson County would be the natural lead on the establishment of a Surface Water Management District in unincorporated areas of the county. Individual cities and towns could join Jefferson County's effort, establish their own individual utilities, or do neither. For example, Port Townsend currently has its own storm and surface water utility, as does the North Bay area of Port Ludlow.

Recommendation: Consider Surface Water Management Districts as part of Surface Water Management Planning.

See the recommendation for option 4.2.4.2, Adopt Surface Water Management Plan. A Surface Water Management District is one option that should be considered for funding implementation of Surface Water Management Plans.

4.2.1.2 Pursue Other Funding Options

Problem Statement

As stated above, limited or unstable funding sources hamper Planning Unit members' ability to implement surface water management programs and projects. Funds are needed for activities ranging from education and outreach to restoration projects to enforcement of existing regulations.

Description of Option

The previous option describes the formation of a surface water management district. However, other funding options do exist, including the following:

- Raising taxes or levies;
- Creating a special assessment to fund the Jefferson County Conservation District's surface water management projects; or
- Diverting funding from other programs to water quality programs.

These options are described more fully below.

Raising taxes or levies could take several forms. Cities and counties both can raise utility taxes up to 2 percent without voter approval (Association of Washington Cities et al., 2003). However, Jefferson County currently does not impose a utility tax. Counties also can raise property taxes up to a certain amount set by law (RCW 84.55.005), or over that amount with voter approval.

Counties and cities can use property taxes, which go into general funds, for watershed planning. In April 2003, the Washington State Legislature passed ESB 5073, which allows counties, cities, and special districts such as utility districts to dedicate up to 10 percent of their water-related revenues to be spent on watershed planning. Port, utility, irrigation, aquifer protection, shellfish protection, flood control and diking districts all are eligible (Washington State Senate, 2003). In Jefferson County, this bill relates most directly to the port district and to the utility district. These utilities could devote existing funds, or increase their assessments and dedicate 10 percent of the new funds, to watershed planning programs, which include many surface water management activities.

The Washington Legislature created conservation districts in 1939 with the passage of RCW 89.08. This law allows counties to establish special assessments to fund conservation district activities. However, currently Jefferson County supports the Conservation District out of its general fund, rather than using a special assessment. The county could choose to create a special assessment and dedicate all or a portion of the assessment to surface water management activities, such as fencing livestock away from streams or planting riparian buffers.

Lastly, cities and counties both could reduce funding for other programs and use the balance to fund surface water management programs. However, it is often difficult to cut existing programs.

Rationale

Any one of these three options – raising taxes, implementing a conservation district assessment, or diverting general funds – could generate funding for surface water management activities. However, raising taxes or creating new assessments are very difficult in the current budget climate, and cutting existing programs is never popular.

Potential Implementers

The County and the City could both raise property taxes or cut existing programs. Under ESB 5073, the Public Utility District and the Port could both dedicate up to 10 percent of their funding for watershed-

related activities. In addition, the County could work with the Jefferson County Conservation District to implement a new special assessment that supports the Conservation District's surface water management activities.

Recommendation: Pursue other funding and revenue options.

The Planning Unit recommends that its members should consider all feasible funding options to implement the plan.

4.2.2 OPTIONS FOR INCREASING AND IMPROVING CONSERVATION PRACTICES

4.2.2.1 Continue Conservation District Program with Landowners

Problem Statement

Agricultural practices can impact water quality. In particular, improperly managed livestock manures contribute bacteria and nutrients to local waterways, and livestock can trample unfenced streambanks, leading to reduced riparian cover and increased erosion.

Description of Option

The Jefferson County Conservation District currently assists local farmers with conservation practices that protect and improve water quality. For example, the Conservation District collects monthly water quality data from 16 monitoring stations in the agriculture-intensive Chimacum Creek basin. Staff then send the fecal coliform statistics to farmers in the basin. Follow-up assistance is also provided to the farmers to help establish conservation practices, or identify potential funding through programs like Washington's Conservation Reserve Enhancement Program (discussed below) or the Federal Environmental Quality Incentives Program (EQUIP) (Latham, 2003). The Conservation District also monitors water quality in the Tarboo, Donovan, Jakeway, Salmon, Snow and Andrews Creek watersheds.

In addition, the Conservation District also supports water quality through programs such as "Horses for Clean Water." Horses for Clean Water is a program that travels throughout Puget Sound to offer environmentally sensitive horsekeeping education through classroom series, workshops, farm tours, demonstration farms and educational materials development.

Overall, the Conservation District has for many years done an exemplary job working with agricultural landowners, on a voluntary basis, to improve land use management practices that impact water quality. The Conservation District should continue its existing efforts and look for ways to work with even more interested landowners.

Rationale

The WRIA 17 Technical Assessment shows that some water quality parameters do not meet state water quality standards in many WRIA 17 streams and rivers. Outreach, technical assistance, or facilitation is needed to provide farmers and landowners with incentives and technical assistance to establish best management practices. The Jefferson County Conservation District helps landowners and farmers establish practices such as livestock fencing and planting riparian buffers, tracks program success through ongoing water quality monitoring, and provides information back to landowners and farmers on the further need to manage agricultural operations to protect and improve water quality. These efforts have been very successful and should be continued and expanded.

Potential Implementers

The Jefferson County Conservation District is already serving this role.

Recommendation: Continue Conservation District program with landowners.

The Planning Unit recommends that the Jefferson County Conservation District continue its successful work with landowners to help them implement conservation practices that protect and improve water quality. Funding for Conservation District educational programs, such as the "Horses for Clean Water" program, should continue.

4.2.2.2 Protect and Restore Riparian Vegetation

Problem Statement

Agricultural, forestry, and development practices can impact water quality. In particular, grazing livestock, growing crops, or building structures directly adjacent to streams can lead to stream pollution and/or stream bank erosion.

Description of Option

Riparian buffer zones are commonly used to protect water quality of streams and other waterways. Riparian buffer zones are areas immediately adjacent to waterways that are planted with trees or otherwise managed to limit the impact of nearby land use practices on water quality. For example, a farmer might plant a band of trees adjacent to a stream and fence it off to exclude livestock. Programs such as the Conservation Reserve Enhancement Program offer incentives for landowners to establish riparian buffer zones on their properties. A possible option for improving water quality in WRIA 17 is to expand these programs and create more riparian buffer zones.

More than one program in the watershed is involved in encouraging riparian buffer zones. The largest of these programs, the Conservation Reserve Enhancement Program (CREP), is a joint federal and state program administered locally by the Conservation District. The CREP provides agricultural landowners rent assistance and other incentives in exchange for taking crop or pastureland out of production. The goal of the program is to improve water quality and improve salmon habitat by re-establishing natural, forested riparian buffer zones along salmon-bearing streams bordered by agricultural land. The program will pay applicable land rental costs, all of the cost of establishing the buffers (Jefferson County Conservation District, 2003), and all of the monitoring costs in exchange for maintaining a riparian buffer zone for a period of at least 10 to 15 years. The CREP is a cooperative program of the US Department of Agriculture's Farm Service Agency, the Commodity Credit Corporation, and the State of Washington (US Department of Agriculture, 1998).

Currently, the CREP targets salmon-bearing streams in agricultural areas. However, other streams and stream reaches may also benefit from the re-establishment of vegetated riparian zones, and could be the focus of an expanded or supplementary program.

Some similar, but broader, efforts are already underway. For example, the County Conservation Futures program was initiated in July 2002 as a land preservation program. Conservation Futures focuses on protection of threatened areas of open space, timberlands, wetland, habitat areas, agricultural and farm lands within the boundaries of Jefferson County (Jefferson County, 2003). Through this program, Jefferson County will purchase or acquire development rights to critical pieces of land and preserve them as open space. In addition, the Jefferson Land Trust has a

Jefferson County Setback Requirements

Stream	Setback
Type 1 & 2	150 ft.
Type 3 & 4	100 ft
Type 5	50 ft

voluntary program through which property owners can create conservation easements and donate certain rights (such as mining, timber, or development) to the Trust.

Finally, it is important to note that a 2003 revision to the Jefferson County Unified Development Code (UDC) changed language that exempted existing agriculture from regulation as "environmentally sensitive areas." This change is part of a settlement agreement with the Washington Environmental Council (WEC), which appealed Jefferson County's UDC in 2001 because the Critical Areas Ordinance exempted agricultural activities from environmental protections in environmentally sensitive areas. The revision amends the UDC so that the exemption only applies to existing lands of long-term agricultural significance, and not to "hobby farms." The result of this change is that the establishment of new farms is subject to more rigorous review, and new farms may be required to establish a pre-determined buffer zone beside streams. Furthermore, in those areas where the exemption remains, Jefferson County is actively engaging the agricultural community in a program of voluntary habitat and water quality improvements.

In summary, a variety of relatively new programs address the re-establishment of vegetated riparian buffers beside streams on agricultural and residential land. Given the similar goals of each program, there may be an opportunity to work together toward the common goal of re-establishing vegetated riparian buffers to preserve water quality.

Rationale

Vegetated riparian buffers help protect water quality by maintaining a significant distance between agricultural practices or development and bodies of water. Plants in buffer zones keep water temperatures low and trap pollutants, such as excess sediment or pesticides that otherwise would end up in streams.

Potential Implementers

Currently, the Conservation District, Washington Conservation Reserve Enhancement Program, the Land Trust, and the Conservation Futures Program help establish riparian buffer zones or similar conservation reserves. Jefferson County is also an implementer, to the extent that its Unified Development Code requires development to observe buffer distances from streams and other habitat areas.

Recommendation: Protect and restore riparian vegetation.

The Planning Unit recommends that member organizations work to protect and restore riparian vegetation. Specifically, the Jefferson County Conservation District should continue its work with landowners through programs such as the Conservation Reserve Enhancement Program (CREP). Jefferson County should continue its Conservation Futures grant program and focus part of the funds on acquiring and/or protecting riparian areas. The County also should enforce provisions of the Unified Development Code that protect riparian buffers. Lastly, the Planning Unit encourages the Jefferson Land Trust to continue its work with landowners, JCCD, and NOSC to identify and develop conservation easements on riparian areas. These implementers should continue to work together to ensure that protection and improvement of riparian areas is coordinated and effective.

4.2.2.3 Reduce Pesticide Use

Problem Statement

Pesticides, including insecticides and herbicides, in water bodies have been shown to harm aquatic life (National Academy of Sciences and National Academy of Engineering, 1973). Washington State has set standards for surface water quality that may be violated by the presence of these chemicals (State of Washington, 1992).

Description of Option

A variety of means could be pursued to reduce pesticide use. In general, these may be categorized as:

- **Education, outreach, and technical assistance** to pesticide users. Such an approach could involve media and promotion campaigns, workshops, or one-on-one site visits by technical staff to educate users about the impacts of these chemicals, minimization techniques, and the safe, viable alternatives that currently exist. These campaigns could focus on farms, residences, and/or commercial users (such as resorts and golf courses).
- **Certification programs and market incentives.** Increasingly, consumers are beginning to choose products and services that are produced without pesticides. The most visible example of this trend is the growth in Certified Organic agriculture. On a more local level, the Puget Sound regional Envirostars program certifies businesses (including landscapers) that protect water quality by minimizing hazardous waste. The Envirostars program offers recognition, free marketing, and advertising to businesses that it certifies (Envirostars Cooperative, 2003).
- **Establish a Pest Management Policy.** Cities or counties can adopt Pest Management Policies to guide their own pest management on government properties, parks, schools, playfields, etc. For example, Seattle and King County have adopted policies eliminating pesticide use or calling for Integrated Pest Management, a low-impact management technique. Along these lines, Jefferson County has instituted a "no-spray" policy for controlling roadside vegetation. Further restrictions or policies could be instituted for government practices. The Northwest Coalition for Alternatives to Pesticides publishes a summary of pest management policies in their *Clean Water for Salmon Pesticide Action Kit* (Northwest Coalition for Alternatives to Pesticides, 2003).
- **Bans or restrictions on the use of pesticides.** Pesticide bans and restrictions have been executed at city, county, state, and federal levels. For example, residents of Fairfax, California are prohibited from using pesticides on private property unless they first post notification signs for 48 hours before and after spraying, and notify in writing 48 hours prior to pesticide use all neighbors within 150 feet of the property (Northwest Coalition for Alternatives to Pesticides, 2003).

Rationale

Decreasing use of pesticides and insuring their proper handling and storage would directly benefit water quality in WRIA 17.

Potential Implementers

The Jefferson County Conservation District or WSU Cooperative Extension could potentially implement education, outreach, and technical assistance to agricultural users. The Jefferson County Public Works Department, as well as individual cities or environmental groups, could implement education and outreach to residential users. Government agencies could continue and/or improve their pest management policies. For example, the Washington Department of Transportation could complete implementation of its integrated pest management policy for state highways. The Jefferson County Department of Environmental Health could expand the EnviroStars program it currently administers to include landscapers.

Recommendation: Reduce pesticide and herbicide use.

The Planning Unit recommends that Planning Unit members implement one or more of the following programs to reduce pesticide use:

- Provide education, outreach, and technical assistance to pesticide users;
- Develop certification programs and market incentives;

- Establish a Pest Management Policy; and/or
- Ban or restrict the use of pesticides.

4.2.2.4 Reduce Use and Release of Synthetic Organic Compounds

Problem Statement

Synthetic organic compounds are chemicals synthesized from carbon and other elements such as hydrogen, nitrogen, or chlorine. These chemicals are manufactured to meet hundreds of needs in our daily lives, ranging from mothballs to hair sprays, from solvents to pesticides. The use of these synthetic organic compounds has greatly increased within the past 40 years and some of these gradually have made their way into surface and groundwater. Many pesticides and other synthetic organic compounds are potent chemicals with health effects in humans at very low concentrations.

Most synthetic organic compounds are also persistent organic pollutants (POPs). POPs are "organic chemicals characterized by their persistence in the environment, their tendency to accumulate in the food chain, and their ability to travel long distances in air and water, posing a risk to human health and the environment far from the site of their use and release" (Eckley, 2001). However, even those that are not persistent can pose harm to wildlife, including salmon, if present in sufficient quantities (Collins, 2003).

Description of Option

Pesticides, one of the largest categories of synthetic organic compounds, were addressed above in option 4.3.2.3. Other particularly dangerous synthetic organic compounds likely present in WRIA 17 include:

- **Dioxins.** One of the best studied and most toxic synthetic organic compounds, dioxins are a chlorine byproduct produced during many industrial activities, including pulp and paper bleaching (Eckley, 2001). A Washington Department of Fisheries report found that dioxins released from pulp mills near Grays Harbor (at Aberdeen in WRIA 22) likely influenced survival of coho salmon (Washington Department of Fisheries, 1992). While dioxins are likely present in WRIA 17, it is important to note that Port Townsend Paper does not use chlorine-based bleaches, and therefore does not generate dioxins.
- **Polychlorinated biphenyls (PCBs).** PCBs can be found in a variety of items, including in electrical dielectrics and transformers, as heat exchange fluids, and in paints. Although currently banned in the U.S., they may still be present in older equipment, fluids, and paints.
- **Furans.** Furans are produced by the production of other chemicals (similar to dioxins). They are generated by the burning of waste, coal, peat, or wood, and are present in automobile exhaust.
- **Pentachlorophenol.** This a persistent wood-treating chemical, used in such applications as utility poles.

Options to address the use and release of synthetic organic compounds should focus both on safely disposing existing synthetic organic compounds and on preventing their use and generation in the first place.

Safely disposing of synthetic organic compounds would first involve identifying exactly where they are present. This could involve a study of existing electrical transformers, pulp and paper sludges, wood treatment companies, shipyards, and lubricants at industrial facilities, etc. The next step would involve safely disposing the materials.

Preventing the use and generation of synthetic organic compounds brings other challenges. In particular, industrial facilities would need to evaluate their practices and chemical uses and choose alternative methods. In addition, a wide variety of consumer products contain synthetic organic compounds.

Strategies to eliminate the use and generation of synthetic organic compounds could involve bans and phaseouts. Strategies targeted more specifically at protecting water quality could include the following (Washington Toxics Coalition, 2000):

- **Prohibiting mixing zones.** Under Ecology's *Water Quality Standards for Surface Waters of the State of Washington* (WAC 173-201A), a polluter may be granted a "mixing zone" into which it may discharge effluent. The mixing zone is a region of water (up to 300 feet from the point of discharge) within which the facility will not need to meet water quality standards. Eliminating mixing zones would require facilities to meet water quality standards at the "end of pipe."
- **Establishing deadlines** for achieving zero discharge for synthetic organic compound, or persistent organic pollutants.

Rationale

Synthetic organic compounds are toxic to humans and wildlife. Washington State has recognized the danger and is pursuing strategies to reduce several persistent chemicals (Washington Department of Ecology, 2001). Organizations in WRIA 17 can assist these efforts by taking local action.

Potential Implementers

Reducing or eliminating the use and generation of synthetic organic compounds would necessarily involve a broad coalition of implementers. Local governments and industries could work together to identify synthetic organic compounds, dispose them, and find alternatives. Bans and phase-outs would perhaps best be accomplished at the State level, rather than at the county level.

Recommendation: Reduce use and release of synthetic organic compounds.

The Planning Unit recommends that local governments and industries work together to identify synthetic organic compounds, find ways to dispose them safely, and develop alternatives to these products. Planning Unit member organizations could encourage the state to ban or phase out specific synthetic organic compounds.

4.2.3 Options for Involving the Public

4.2.3.1 Citizen Water Quality Monitoring

Problem Statement

Water quality data are not available for many WRIA 17 sub-basins and marine nearshore areas. Citizen groups, which can become personally involved in watershed quality and protection, can fill this gap.

Description

Water quality monitoring is often completed by government agencies. However, citizen groups may be interested in contributing to monitoring, both for their personal interest and as a way to involve themselves in the community. From a government perspective, citizen involvement can help cut costs while obtaining data from more watersheds.

Moreover, citizen involvement in water quality monitoring serves as an important educational tool. Ultimately, water quality improvements will likely only be achievable to the extent the general public is interested and invested in conservation measures.

Many excellent monitoring programs already utilize volunteers in WRIA 17. For example, a citizen water quality monitoring project is currently underway in the Leland Creek watershed, which is part of the Little

Quilcene River sub-basin. Organized by the non-profit Pacific Ecological Institute, the project is involving local businesses, industry, government agencies, community organizations, households, and students in developing skills and monitoring Leland Creek. A baseline of useable data will be established and used by Jefferson County Environmental Health and other county offices to guide decisions on management and protection of water quality.

The Jefferson County Conservation District also relies on volunteers to collect water quality data. Volunteers have assisted in collecting water samples, laboratory analyses at the District's lab, and taking samples to Twiss' laboratory in Poulsbo. Members of the volunteer organization Wild Olympic Salmon initiated the District's intragravel dissolved oxygen monitoring program five years ago. Students from Chimacum High School's hydrology class have also assisted the District. The students have been collecting and analyzing water samples from 10 stations on Chimacum Creek since 1998. In sum, over the past 10 years volunteers have contributed thousands of man-hours to the Jefferson County Conservation District's water quality program.

Examples of other citizen water quality monitoring efforts in neighboring counties include the Clallam County Streamkeepers and the Kitsap County Stream Team.

Rationale

Citizen involvement in watershed protection can lead to behavioral changes among residents as they take increasing pride in the beauty and health of their watershed and marine nearshore areas, and act accordingly to maintain it. When schools are involved, students can become more knowledgeable about threats to water quality in their area and how they personally can protect the natural environment in which they live. In addition, citizen water quality monitoring provides valuable data to Jefferson County to help guide water quality management decisions.

Potential Implementers

A wide variety of non-profit, school, or community groups could serve as a lead in organizing citizen water quality monitoring. For data to be useful to watershed planning efforts, Planning Unit members such as Jefferson County and the Conservation District should be project partners. Washington State University Cooperative Extension, Port Townsend Marine Science Center, and the North Olympic Salmon Coalition can also be important project partners.

Recommendation: Citizen water quality monitoring.

The Planning Unit recommends that Planning Unit members and other institutions/ organizations encourage and, if feasible, provide financial support for local citizen groups to conduct water quality monitoring programs that use citizen volunteers to collect data in a manner consistent with the protocols established in the Water Quality Monitoring Plan. An example of such a program is the Pacific Ecological Institute's project on Leland Creek. These programs must be coordinated with government agencies to ensure that the data collected are useful.

4.2.4 Regulatory, Policy, and Planning Options

4.2.4.1 Write a Surface and Ground Water Quality Monitoring Plan

Problem Statement

Development of a surface and ground water quality monitoring plan was one of the primary needs identified in the WRIA 17 Initial Technical Assessment. The water quality monitoring plan is necessary because monitoring is conducted by Tribes, the Hood Canal Coordinating Council, Jefferson County

Conservation District, the City of Port Townsend, Jefferson County, Jefferson County PUD No. 1, public water systems and non-profit corporations. A monitoring plan would assure quality and consistency, improve coordination and be cost effective for future studies.

Description

In January 2003, Jefferson County was awarded a grant from the State Department of Ecology to develop a water quality monitoring plan. The monitoring plan will describe where, how, and what to monitor, as well as how to analyze results. The plan will address both surface and ground water quality monitoring and include the following elements:

- Responsibilities of various agencies
- Data management
- Quality Assurance/Control
- Monitoring protocols
- Data analysis protocols

Jefferson County will also develop an assessment of whether current water quality actions are sufficient to achieve compliance with State water quality standards.

Rationale

As mentioned above, a WRIA 17 water quality monitoring plan will be very useful to improve coordination and assure quality, consistency, and cost-effectiveness of the water quality monitoring currently undertaken by a variety of agencies. In addition, the Watershed Planning Act requires the inclusion of such a water quality monitoring plan in any watershed plan that includes a water quality component (RCW 90.82.090), and the WRIA 17 Technical Assessment identified development of such a plan as a primary need for the watershed.

Potential Implementers

Jefferson County Natural Resources Division will be contracting Golder Associates on behalf of the WRIA 17 Planning Unit to complete this plan.

Recommendation: Implement a surface and ground water quality monitoring plan.

The Planning Unit recommends that a surface and groundwater monitoring plan is implemented. This plan will help coordinate the monitoring efforts of a wide variety of agencies in the watershed.

4.2.4.2 Adopt Surface Water Management Plans to Decrease Stormwater Impacts on Nearshore Marine Water Quality

Problem Statement

Stormwater, a byproduct of urban development, can adversely impact nearshore marine water quality and habitat. Stormwater can carry pollutants, such as nutrients that may lower dissolved oxygen levels and fecal coliform, which may lead to shellfish area closures in the marine environment. For example, shellfish areas have been closed at the mouth of Sequim Bay due to non-point pollution in Bell Creek. In addition, stormwater can increase nearshore erosion through scouring.

Description of Option

Comprehensive stormwater management is one important element of surface water management plans, which address a broad range of issues that affect surface water. The Puget Sound Water Quality Management Plan (section SW 1.2) lists the following elements of comprehensive stormwater management, as follows:

- Stormwater controls for new development and redevelopment;
- Stormwater site plan review;
- Inspection of construction sites;
- Maintenance of permanent facilities;
- Source control;
- Illicit discharges and water quality response;
- Identification and ranking of problems;
- Public education and involvement;
- Low impact development practices;
- Integration with watershed planning;
- Stable funding source;
- Monitoring; and a
- Schedule for implementation (Puget Sound Water Quality Action Team, 2000).

Comprehensive stormwater programs will vary among jurisdictions, depending on the jurisdictions' population, density, threats posed to stormwater, and results of watershed planning efforts. Jurisdictions are encouraged to form intergovernmental cooperative agreements in order to pool resources and carry out program activities most efficiently (Puget Sound Water Quality Action Team, 2003).

Jefferson County is currently developing a surface water management plan, to be completed by the end of 2003. The plan will address impacts to surface water from urban development, agriculture, and forestry.

Because surface water management plans address stormwater, they can be tools for decreasing the effects of stormwater on nearshore marine water quality. The Jefferson County plan will project likely changes, such as population increases and expected development, which are likely to influence stormwater in the future. Based on this information, the plan will identify areas where stormwater could impact nearshore water quality and habitat and make recommendations for mitigating these impacts.

In addition, Port Townsend has developed a draft surface water management plan, but it has never been adopted.

Rationale

Adopting surface water management plans would be a useful step in coordinating surface water management activities to protect water quality.

Potential Implementers

The primary implementers of the plans would be Jefferson County and the City of Port Townsend, but other cities and the Port of Port Townsend could also develop and pass surface water management plans. Many groups could be involved in implementing plan provisions.

Recommendation: Adopt surface water and/or stormwater management plans.

The Planning Unit recommends that Jefferson County and the City of Port Townsend develop surface water and/or stormwater management plans that describe how water quality and water resources will be protected and restored. Port Townsend and Port Ludlow already collect fees to treat and manage stormwater, and should continue their efforts.

4.2.4.3 Adopt and implement a Stormwater Management Manual

Problem Statement

Urban development causes significant changes in patterns of stormwater flow from land into receiving waters. Water quality can be affected when runoff carries sediment or other pollutants into streams, wetlands, lakes, and marine waters or into ground water.

Description of Option

The Puget Sound Water Quality Action Team's *Puget Sound Water Quality Management Plan* (2000) calls for cities and counties to adopt a Stormwater Management Manual to guide their water quality efforts. Stormwater manuals are one element of comprehensive stormwater management (see Option 4.2.4.2 for more information). The *Management Plan* (Puget Sound Water Quality Action Team, 2000) encourages local governments to adopt the Department of Ecology's *Stormwater Management Manual for Western Washington.* The objective of this manual is to "provide a commonly accepted set of technical standards and guidance on stormwater management measures." The Department Ecology believes that when the standards and recommendations of the manual are properly applied, stormwater runoff should generally comply with water quality standards and protect beneficial uses of the receiving waters (Washington Department of Ecology Water Quality Program, 2001).

Although the manual itself has no independent regulatory authority, Puget Sound's Water Quality Management Plan calls for local governments to adopt the Stormwater Management Manual or an "equivalent" manual (Puget Sound Water Quality Action Team, 2000). Local governments in WRIA 17 may wish to ensure that the manual selected recognizes the predominantly rural character of the watershed.

The 2001 version of Ecology's *Stormwater Management Manual for Western Washington* is appropriate for use throughout Western Washington. It contains a suite of best management practices aimed at cleaning up and controlling stormwater, primarily from new development and redevelopment of commercial, industrial, and residential properties, and road projects (Washington Department of Ecology Water Quality Program, 2001).

Other manuals developed in Washington State include the 1998 King County Surface Water Design Manual, and the Stormwater Manual for Eastern Washington, which is in final draft form (Washington Department of Ecology Water Quality Program, 2003). Although King County is more urbanized than Jefferson County, significant portions of the county are still rural, with agriculture and forestry as primary land uses. King County currently is updating its manual so that it complies with Endangered Species Act requirements, and becomes equivalent to the Ecology manual (King County Water and Land Resources Division, 2003b). The Eastern Washington manual likely is not appropriate for Jefferson County because of climatic differences.

Other options include the US EPA's national best management practices for NPDES Stormwater Phase II, which can be downloaded from their website at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm. Other states also have developed stormwater manuals or sets of best management practices, including California, Utah, Texas, and Virginia (American Public Works Association, 2003).

Like the Eastern Washington manual, however, these manuals may not be appropriate for use in Western Washington due to climatic differences.

Once a manual is selected and adopted, the requirements and technical guidance in the manual can then become required through:

- Ordinances and rules established by local governments; and
- Permits and other authorizations issued by local, state, and federal authorities.

Rationale

By adopting the Stormwater Management Manual or its equivalent, local governments in WRIA 17 could establish shared best management practices for engineers, planners, environmental scientists, plan reviewers, and inspectors in the region. These common best management practices, if implemented, would serve to minimize the effect of development on water quality. Follow-up actions could then include making such practices mandatory through ordinances or through the permitting structure.

Potential Implementers

Cities and counties in WRIA 17 could adopt the Stormwater Management Manual or equivalent manual.

Recommendation: Adopt a Stormwater Management Manual.

The Planning Unit recommends that communities in WRIA 17 adopt the 2001 Ecology Stormwater Management Manual or its equivalent.

4.2.5 Options for Facilitating Existing Efforts

4.2.5.1 Coordinate Planning Across Numerous Agencies

Problem Statement

Currently a large number of agencies are involved in community planning and natural resource management in WRIA 17. With a variety of missions and responsibilities, the various agencies may find it challenging to find time to work collaboratively on common goals.

Description of Option

Many agencies are involved in community planning in WRIA 17, including but not limited to the following:

- **Local Planning Commissions** have the responsibility of developing comprehensive plans for cities and counties. These plans put forth the "vision" for each community, and often include sections that may impact water quality—such as land use planning, environmental protection, and storm and surface water management.
- **Jefferson County PUD No. 1** provides water and sewer services for east Jefferson County. It also attempts to resolve water resources disputes and serves on many commissions, including the Jefferson County Water Resources Council.
- **Jefferson County Water Resources Council** attempts to build relationships, to set priorities and to solve problems related to water resource issues. The purpose of the council is to provide a collaborative forum for coordination and cooperation among all interests (Jefferson County Water Resources Council, 1999).

- **The Jefferson County Marine Resource Committee** is "is a citizen-based effort to identify regional marine issues, foster community understanding and involvement, recommend positive action and develop support for various protection and restoration measures" (Jefferson County Marine Resources Committee, 2002).
- **The Hood Canal Coordinating Council** is a watershed based Council of Governments that was established in 1985 in response to concerns about water quality problems and related natural resource issues in the watershed. The mission of the HCCC is to "advocate for and implement locally-appropriate actions to protect and enhance the Canal's special qualities" (Hood Canal Coordinating Council, 2003).
- **Area Tribes** with interests in the protection and restoration of water quality in the WRIA include the Skokomish Tribe, as well as the Port Gamble, Jamestown, and Lower Elwha S'Klallam Tribes. The Tribes maintain their own natural resources staff who are specifically focused on water quality impacts to fish, shellfish, and wildlife resources protected under the Point No Point Treaty of 1855.

Clearly, a variety of planning is taking place in Jefferson County related to water resource issues. Coordination of these various organizations could happen through one of the existing organizations or by a third-party organization.

Rationale

Some form of coordination will likely be necessary to efficiently and cost-effectively make improvements to water quality in WRIA 17, as recommended in this plan.

Potential Implementers

The WRIA 17 Planning Unit could initiate this process, perhaps by inviting members of the above groups to a working session to identify ways to work together and increase efficiency. Other groups, such as the Jefferson Water Resources Council, Jefferson County, or the PUD, could also initiate this process.

Recommendation: Coordinate planning across numerous agencies.

The WRIA 17 Planning Unit recommends that coordinated planning continue among a variety of agencies, including local planning commissions, the Jefferson County PUD #1, the Jefferson County Water Resources Council, the Jefferson County Marine Resources Committee, the Hood Canal Coordinating Council, and area tribes.

4.2.5.2 Work with Department of Health to Upgrade Water Quality Data Accessibility

Problem Statement

The Washington State Department of Health (DOH) monitors public drinking water systems and makes the data available on their web site. Local planners commonly download and integrate this information with their local, spatial databases to monitor groundwater quality and identify possible contaminants. However, the Department of Health's data can be difficult to cross-reference with local data systems. In particular, local jurisdictions report difficulty matching up DOH data with the specific wells they study.

Description of Option

Local planners in every WRIA, including WRIA 17, rely on obtaining information about drinking water quality from Group A and Group B public water systems.[1] Although the current DOH data system enables periodic integration of drinking water quality data with local data and tracking systems, a more streamlined connection between the DOH and local systems would greatly aid ongoing local efforts. The Department of Health could work with local jurisdictions, including WRIA 17, to determine local data needs and identify and make necessary upgrades to the water quality data. One much-needed upgrade would be to include the Department of Ecology's unique well number with each database record.

Rationale

Easy and effective data access is necessary to monitor drinking water quality, respond to any contaminants, and assure future water safety.

Potential Implementers

The Washington State Department of Health controls and operates the water quality database.

Recommendation: Work with state agencies to upgrade water quality data accessibility.

The Planning Unit recommends that its members encourage the Washington Department of Health and other state agencies to determine local data needs, and identify and develop a useable water quality database. These updates should include adding the Department of Ecology's unique well number to each database record.

[1] Group A denotes a water system providing service such that it meets the definition of a public water system provided in the federal Safe Drinking Water Act – that is, a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least 15 service connections or regularly serves at least 25 individuals. Group B signifies a public water system that does not meet the definition of a Group A water system – that is, a public water system constructed to serve: less than 15 residential services regardless of the number of people; or an average nonresidential population of less than 25 per day for 60 or more days within a calendar year; or any number of people for less than 60 days within a calendar year (WAC 246-290-020, WAC 246-291-010, and 42 USC 300f(4)).

4.3 Habitat Options

The Quilcene-Snow Watershed Planning Unit (WRIA 17) recognizes the need to protect and restore streams, estuaries and the nearshore for the benefit of at-risk salmon, as well as numerous other aquatic and riparian-dependent wildlife species. The salmon habitat protection and restoration efforts must also ensure clean water in sufficient quantities to provide adequate salmon habitat as well as adequate supplies for human use. The Planning Unit also recognizes that other salmon-recovery planning efforts are progressing this region, particularly that of the Hood Canal Coordinating Council. The Hood Canal Coordinating Council's salmon recovery plan provides a comprehensive approach that will describe a strategy of protection, restoration, rehabilitation, and substitution for salmon habitat throughout Hood Canal and the eastern Strait of Juan de Fuca, including WRIA 17. The HCCC plan will be a mixture of land use and regulatory management actions combined with specific habitat restoration and rehabilitation projects. Because the Hood Canal Coordinating Council's plan will recommend specific habitat projects for implementation, the Planning Unit has focused on policy and programmatic recommendations that will complement, rather than duplicate, the Hood Canal Coordinating Council's forthcoming plan.

4.3.1 PROGRAM OPTIONS

4.3.1.1 Create and implement a transfer of development rights program (TDR)

Problem Statement

Native salmon range from the foothills of the Olympic Mountains to Puget Sound, covering hundreds of miles of streams and rivers on their way. Acquiring all of this habitat for protection is not feasible, so other solutions are necessary. Solutions that are market-based often are particularly attractive.

Description of Option

Transfer of development rights (TDR) programs allow individuals to purchase and sell residential development rights from lands that provide a public benefit such as forest, trails, open space, or habitat for threatened or endangered species. Transferred development rights can be used to build additional houses on other parcels in more appropriate areas such as designated urban growth areas. TDR programs have many benefits: landowners who sell development rights receive financial compensation without developing or selling their land, the public receives permanent preservation of the land, and developers can continue to build at higher densities. A TDR also responds to growth management objectives by focusing growth in urban areas where services such as sewer, water and transportation exist or can be readily provided. In western Washington, Clallam, Thurston, Island, and King Counties have or have had TDR programs (American Farmland Trust, 2001; Clallam County, 2003; King County Water and Land Resources Division, 2002) and Snohomish and Kitsap Counties are currently investigating beginning them (Gurol, 2003 and Labbe, 2003).

TDR programs require the designation of "sending" sites, or areas from which development rights may be sold, and "receiving" sites, or areas where development credits may be applied. WRIA 17 is largely rural, with only one incorporated city as of 2003. However, TDR programs have worked in other rural areas where sending and receiving areas have been defined clearly and there is some development pressure.

For example, The Pinelands, New Jersey, is a rural area where a TDR program has protected over 12,000 acres since the early 1980s (New Jersey Pinelands Commission, 2003). The Pinelands is a National Reserve, and is the largest area of open space between Boston, MA, and Richmond, VA. Historically,

farming has been important here, especially the berry industry. The Pinelands has clearly defined sending areas – called the Preservation Area District, Agricultural Production Areas, and Special Agricultural Production Areas – and clearly defined receiving areas, called Regional Growth Areas. The Pinelands experiences growth pressures because it is located not far from the Philadelphia, PA – Camden, NJ corridor. The TDR program at The Pinelands is voluntary, although a landowner who sells development credits must enter into a permanent deed restriction.

Similarly, Montgomery County, MD, is a rural area outside Washington, D.C. About one-third of Montgomery County's 316,000 acres are in agricultural use, and the County has created a 93,000-acre agricultural preserve using five different programs. The TDR program has preserved about 41,000 acres (Montgomery County Department of Economic Development, 2001).

These programs indicate that TDR programs in rural areas can be successful. However, some development pressure seems to be necessary to create a market for the credits, and sending and receiving areas must be clearly defined.

In Washington, TDR programs in rural areas have been attempted in several counties but in general have not been as successful as the programs described above. A TDR program exists in Clallam County, but it has never been used because there is little incentive and few opportunities for developers to use the program. Development rights are already relatively easy to obtain, as most of the agricultural reserve has already been subdivided into five-acre parcels, and County administrators haven't been able to work out a mutually beneficial arrangement with the receiving areas of Sequim or Port Angeles (Caldwell, 2003). Similarly, the program in Thurston County hasn't been used (Gurol, 2003) and the program in Island County was reportedly utilized only twice in its eight-year lifespan before being revoked in 1992 (Gaylord, 2002).

Nevertheless, Kitsap County and Snohomish County are considering TDR programs, and Snohomish County has completed a feasibility study (Gurol, 2003). The Snohomish County study made several conclusions about the feasibility of establishing a TDR program, including the following (Gurol et al., 2002).

- TDR programs are only viable where they are the least costly method of achieving developers' goals. Rezones, planned residential developments, or density bonuses in existing urban areas can often be cheaper than obtaining rights through TDR programs
- Similarly, TDR programs must provide the best means of realizing financial return from the landowners property.

If these conditions can be met, research indicates that TDR programs can be successful means of preserving farming, forests, or open space.

Rationale

Outright acquisition of all salmon habitat is not economically feasible, so other solutions are required for protection of these lands. TDR programs can help protect salmon habitat while preserving valued land uses such as farming, forests, or open space.

Potential Implementers

Jefferson County would be the most likely candidate to implement a TDR program, but the County would require cooperation from Port Townsend, the most likely receiving site. Also, if other cities incorporate in the future, the County would need agreements with these new municipalities to allow credits to be sent to them.

Recommendation: Investigate a transfer of development rights program (TDR).

The Planning Unit recognizes the value of TDR programs as planning tools and recommends that Jefferson County and the City explore the possibility of establishing a TDR program in the WRIA. State agencies should be encouraged to fund these efforts by local governments through grants or other funding sources.

4.3.1.2 Develop and implement a public benefit rating system (PBRS)

Problem Statement

As described above, salmon connect mountains to streams to rivers to estuaries to oceans. Each watershed contains hundreds acres of habitat that is important to salmon, but acquiring it all is not practical. Other solutions, particularly market-based solutions, are needed.

Description of Option

Public benefit rating systems (PBRS) are one such market-based solution. RCW 84.34, the Open Space Taxation Act, provides for these programs under state law. PBRS encourage private landowners to conserve sensitive areas by taxing the property at a value consistent with its current use, rather its value if it were to be developed. This change in taxation usually results in a significant tax break for the property owner, almost always greater than 50 percent and sometimes as much as 90 percent for that portion of the property that is enrolled in the program (King County Water and Land Resources Division, 2003a). To receive this tax break, the landowner must keep the property in its current use. About one-third of Washington counties have PBRS in place (Washington Department of Ecology Shorelands and Environmental Assistance Program, 1999).

PBRS are a subset of Current Use Taxation programs, which are available in every county in Washington. Under Current Use Taxation programs, landowners apply to the county government to have their property classified as open space. If the property is in an unincorporated area, the county government can decide whether to approve the application; if the property is in an incorporated area, then a committee of three county and three city legislators makes the decision. All Washington counties except Asotin, Columbia, Franklin, Pend Oreille, Garfield, and Whitman have some properties in the Current Use Taxation Program (Washington Department of Ecology Shorelands and Environmental Assistance Program, 1999).

However, the categories in the Current Use Taxation program are rather broad. Therefore, a county can decide to create a PBRS, and in doing so, establish specific priorities and criteria for the types of lands and resources that the PBRS will conserve. This process occurs as part of the development of an open space plan. Typically, the categories of land use in PBRS include the following (Washington Department of Ecology Shorelands and Environmental Assistance Program, 1999):

- Historic and archaeological sites
- Farm and agricultural conservation land
- Recreational areas
- Urban open space and scenic vistas
- Significant plant and animal habitats and/or species
- Geologic and shoreline features
- Water features
- Riparian habitat
- Forestlands, floodplains, and restoration

Several of these land use categories could benefit salmon habitat, including significant animal habitats and/or species, geologic and shoreline features, water features, riparian habitat, and forestlands, floodplains, and restoration.

One common concern about PBRS is that local governments will lose revenue if they implement these programs. However, these programs usually result in a tax shift, rather than a tax loss (Washington Department of Ecology Shorelands and Environmental Assistance Program, 1999).

PBRS are voluntary, and landowners can withdraw at any time. However, if a landowner withdraws his property from the program, the landowner must pay up to seven years of tax savings, plus interest, and a penalty unless the property was enrolled for ten years and the landowner did not violate the terms of the agreement (Washington Department of Ecology Shorelands and Environmental Assistance Program, 1999).

PBRS do not require development pressure to be successful. Rather, they rely on the widespread desire for lower taxes. Like TDR programs, however, they do require counties to define the land uses that are eligible for the program, and the amount of the tax reduction to be associated with each land use.

Rationale

Acquiring all lands that affect salmon habitat is not practical or feasible. Therefore, other market-based solutions are needed to encourage private landowners to engage in stewardship activities. Public benefit rating systems are one such option that is fairly popular in Washington State.

Potential Implementers

By law, PBRS are established at the county level. Thus, Jefferson County would implement this program. However, other Planning Unit members could help educate landowners and alert them to the presence of such a program.

Recommendation: None at this time

The Planning Unit determined this is already being done.

4.3.1.3 Support the Washington Water Acquisition Program

Problem Statement

Even though western Washington is famous for its precipitation, some watersheds still encounter problems with low flows, particularly in the summer months. Flows are naturally lowest in July, August, and September, when there is little precipitation to augment the base flows in the rivers and streams. For example, within WRIA 17, the Chimacum, Quilcene, and Salmon-Snow sub-watersheds experience low flows that hamper fish.

Water withdrawals for water supply, irrigation, industrial processes, domestic purposes, and other beneficial uses can exacerbate these low flows. However, Washington's water law contains a "use it or lose it" principle, in which water rights that are unused can revert to the state. Therefore, the existing legal framework is a significant disincentive for conservation. Other, creative solutions are required to help keep water in rivers and streams for fish and other wildlife use.

Description of Option

One such creative solution is the Washington Water Acquisition Program. Launched by state agencies, the purpose of this voluntary program is to purchase, lease, or receive donations of water rights. In addition, farmers who implement irrigation efficiency projects can place the amount of water conserved in the Acquisition Program so that they do not lose the right to the water. Because the portion of the water

rights placed in the Acquisition Program remains in the stream or river from which it would have been withdrawn, this program can help ensure adequate flows for fish and other resources (Washington Department of Ecology, 2003c).

This program is available in WRIA 17 because it is one of the 16 watersheds designated as supporting vulnerable salmon runs. However, more advertisement of this program is needed to generate additional interest in – and benefit from – this program. Some ideas include the following:

- As the Jefferson County Conservation District continues its work with farmers, it could talk one-on-one with farmers about the possibility of participating in the program.
- The Planning Unit could research which agricultural commodities have weak markets, and target those farmers for possible participation. These farmers might be particularly interested because they would receive money in exchange for selling, leasing, or donating their rights (donations are tax-deductible) that could help offset losses due to weak markets. This idea might be especially appealing to farmers who are taking some acreage out of production until markets improve.
- Similarly, the Planning Unit could meet with representatives of industries with weak markets to discuss this program.
- With the help of state agencies such as the Department of Ecology, the Planning Unit could create a presentation about this program, and give it to community groups such as the Lions, Elks, Rotary Club, and the Chamber of Commerce to spread the word about the program.
- Municipalities that have excess water rights could lease the surplus, thus gaining some funding for other programs and raising awareness of the Acquisition program.

One other impediment to increased participation may be that there is no incentive to sell, lease, or donate water rights other than to save money and/or to protect the environment. The Planning Unit could consider developing some low-cost incentives for participation, such as creating front-yard signs that advertise that a property owner has sold/leased/donated part of his or her water right to help salmon, or publishing a list of participants in the local newspaper alongside a story praising both them and the program.

As of November 2002, the state had $5.5 million available to purchase or lease water rights in the 16 priority watersheds. The Planning Unit may also wish to investigate the possibility of securing additional funds to match the state's funding and thus leverage it. However, the state's funding comes from a mix of federal and state funding sources (Washington Department of Ecology, 2003c), which typically have restrictions on matching with other state and federal funds, so a grant from a foundation or other private source might be the best solution. Although the Salmon Recovery Funding Board does fund projects that protect or restore salmon habitat, their funding also is from both state and federal sources and would suffer from the same restrictions.

Rationale

WRIA 17 has several sub-basins that suffer from low flows. Promoting the state's Water Acquisition Program could help ensure that water remains in these basins to support fish runs and other beneficial uses.

Potential Implementers

All Planning Unit member organizations should participate in implementing this option. Some Planning Unit members may have specific tasks – for example, the Conservation District may be the best organization to work with farmers – but the whole Planning Unit should work together to promote and support this program.

Recommendation: Support the Washington Water Acquisition Program.

The Planning Unit recommends that its member organizations work together to promote and support the Washington Water Acquisition Program. Ideas include conducting outreach to farmers and industries that are interested in water conservation, developing a presentation and giving it to community groups, and considering conservation banking.

4.3.1.4 Expand Citizen-Based Salmon Habitat Programs

Problem Statement

Hundreds of families in WRIA 17 own property that is important to salmon habitat. Although Planning Unit members can and should implement education and outreach programs to educate landowners about habitat protection and restoration options, other education vehicles may be important in WRIA 17, particularly with landowners who prefer not to work with government agencies.

Description of Option

One such education opportunity is Washington State University's Jefferson County Cooperative Extension Olympic Peninsula Water Watcher's Program. WSU provides these citizens with watershed stewardship training, teaching them about water quality issues, how to conduct water quality testing, and ways to protect local water quality. In return, the Water Watchers teach their fellow citizens about these issues (Washington State University, 2003).

The focus of the existing Water Watcher's program is on water quality, although recent volunteer events include teaching school children about salmon habitat, leading explorations of tide pools, and monthly lectures on a variety of topics (Washington State University, 2003). The Planning Unit may wish to work with WSU to expand the Water Watcher's program to include more salmon habitat issues, including ways to protect and restore private property so that it supports healthy salmon runs, and methods of monitoring the habitat. In addition, the program could expand to include nearshore monitoring, or maintenance of a database of monitoring data.

Adding these topics to the curriculum may expand interest in the program, and increase the number of volunteers. The Planning Unit could recommend to WSU that it hire a full-time volunteer coordinator to link volunteers with landowners and agencies that need help.

Rationale

Landowners respond to education programs in different ways. Creating a core group of citizen volunteers who can work with their neighbors one-on-one to protect, restore, and monitor salmon habitat on private property may be the most effective strategy with some landowners.

Potential Implementers

WSU Cooperative Extension would implement these changes. However, Planning Unit members should support WSU, perhaps with materials, supplemental funding, or donated time to train volunteers.

Recommendation: Expand citizen-based salmon habitat programs.

The Planning Unit encourages not-for-profit organizations and citizen groups to address salmon habitat issues. For example, Washington State University is encouraged to expand the Water Watcher's Program to include more salmon habitat issues. In addition, Wild Olympic Salmon, North Olympic Salmon Coalition, Trout Unlimited, and others are encouraged to continue their habitat restoration efforts through ongoing coordinated efforts as well as by developing new partnerships. In support of these

efforts, Planning Unit members are encouraged to provide materials, supplemental funding, or donated time to train volunteers.

4.3.1.5 Advocate for Changes to the Conservation Reserve Enhancement Program

Problem Statement

The Conservation Reserve Enhancement Program (CREP) provides financial incentives to farmers to take agricultural lands out of production. However, the program restricts the duration of contracts to ten to fifteen years, and does not provide incentives for removing lands that border non-fish-bearing streams.

Description of Option

CREP is a state and federal partnership. States must develop proposals for a state CREP program that the governor submits to US Department of Agriculture. The USDA reviews and approves these proposals, which must be consistent with the existing CREP policies. States are expected to provide significant matching funds; the USDA website suggests 20 percent (US Department of Agriculture, 2000).

Under this option, the WRIA 17 Planning Unit would join with other planning units, environmental groups, and agricultural interests to lobby for changes to CREP. Specifically, these changes should include providing indefinite leases when landowners are interested, and making non-fish-bearing streams that are headwaters of fish-bearing streams eligible.

The proposal process may present an opportunity to highlight these desired changes. Although the proposal must be consistent with existing policies, the governor's transmittal letter could recommend these changes.

Rationale

These changes would improve the certainty of habitat protection on some lands, and broaden the reach of the CREP program so that it protects water quality on streams that eventually join fish-bearing streams.

Potential Implementers

As mentioned above, the WRIA 17 Planning Unit should join with other planning units, agricultural interests, environmental groups, and others to form a coordinated lobbying effort to implement this option.

Recommendation: Advocate for changes to the Conservation Reserve Enhancement Program (CREP).

The Planning Unit recommends that its members should join with other planning units, agricultural interests, environmental groups, and others to form a coordinated effort to lobby for changes to this program. Specifically, these changes should include providing adequate funding, indefinite leases when landowners are interested, and expanding CREP to other streams that are currently ineligible.

4.3.1.6 Conserve instream wood, and formalize the Jefferson County Public Works' large wood stockpiling effort

Problem Statement

Large wood represents a critical habitat element in the structure and composition of Pacific Northwest stream ecosystems. Historic and ongoing stream wood cleanouts have damaged aquatic habitat and exacerbated downstream erosion problems. Generally, wood should not be removed from streams. However, large woody debris can damage public infrastructure such as bridges during floods.

Description of Option

The purpose of this option is to ensure no net loss of large wood from streams. Under this option, large woody debris would be left in streams whenever possible so that it can provide habitat structure, cover, and other ecosystem functions. However, in some instances large woody debris can threaten infrastructure. In those cases, the debris should be removed carefully from the stream and placed in a stockpile. This stockpile then can serve as feedstock for restoration projects elsewhere in the watershed.

The Jefferson County Department of Public Works has been stockpiling wood informally. Under this option, the County would make this program an official part of its operations.

Rationale

Implementing this option would preserve large woody debris already present in streams, and provide a reliable source of large woody debris for restoration projects in WRIA 17.

Implementers

As mentioned above, the Jefferson County Department of Public Works could make the large woody debris stockpile part of its normal operations. All Planning Unit members may wish to collaborate on an education effort to heighten public awareness of the importance of large woody debris in streams.

Recommendation: Conserve instream wood, formalize large wood stockpiling efforts, and collaborate on education.

All Planning Unit members should collaborate on an education effort to heighten public awareness of the importance of conserving large woody debris in streams whenever possible. The Planning Unit recommends that governmental agencies make the large woody debris stockpiling part of their normal operations.

4.3.2 POLICY OPTIONS

4.3.2.1 Update and revise maps of sensitive areas

Problem Statement

RCW 36.70A, the Growth Management Act, requires counties and cities of a certain size or population growth rate to develop comprehensive plans to manage growth. As part of these comprehensive plans, jurisdictions are required to identify critical areas (also known as sensitive areas), which include wetlands, aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geological hazard areas such as hillsides subject to landslides (RCW 36.70A.030). The act further requires that jurisdictions use best available science to designate these critical areas and design policies to protect them, and specifies that jurisdictions give special attention to protecting anadromous fisheries (RCW 36.70A.172). The act also sets out a schedule for updating these comprehensive plans, including the critical areas sections. Under this schedule, Jefferson County must update its plan by December 1, 2004, and every seven years thereafter (RCW 36.70A.130). Because Jefferson County's comprehensive plan was submitted in 1994, the maps of critical areas are now nearly ten years old.

In 2003, the Washington Department of Ecology released for public comment a new set of guidelines for updating shoreline management plans. These new guidelines specify that comprehensive plan policies for lands adjacent to shorelines must be consistent with the shoreline management plans. The guidelines also require that jurisdictions classify their shorelines into designations ranging from "natural" to "high-intensity" (Washington State Department of Ecology, 2003d). In conjunction with these new guidelines, the Washington State Legislature amended the timelines for updating these plans. The City of Port

Townsend must complete an updated shoreline management plan by December 1, 2005, and Jefferson County must update its plan by December 1, 2011 (SSB 6012).

Description of Option

The combination of improved information from watershed planning and the upcoming deadlines for revising the County's comprehensive plan, as well as the City's and County's shoreline management plans, provides an excellent opportunity for updating and revising the maps of sensitive areas. Because the Growth Management Act restricts development activities in critical areas, and the proposed shoreline guidelines create "natural" and "rural conservancy" designations, these classifications can be powerful tools for preserving salmon habitat. Under this option, the Planning Unit could encourage the formation of a cooperative program of landowners, the Tribes, Jefferson County, and the Washington Departments of Natural Resources and Fish and Wildlife to collect field data to verify and improve the sensitive areas maps. Other agencies, such as the Jefferson County Water Resources Council, Jefferson County, or the PUD could convene this program also.

For example, water-typing projects, in which trained ecologists walk streams, collect information about fish and map habitat quality. Because many critical areas maps are based upon maps developed by the Washington Department of Natural Resources that underestimate fish presence, these surveys often result in improved identification of fish habitat (Washington Trout, 2001). This new information, if incorporated into Jefferson County's update of its critical areas maps, would result in increased protection of salmon and their habitat.

Involving tribal members and landowners in this project would smooth the path of new field efforts, because surveyors need property owners' permission to access private property. Also, including these groups would increase community support and goodwill for the project.

The project team may also wish to address the frequency of updates to the sensitive areas maps. Currently, state law calls for updates every seven years. With the advent of watershed planning, new information is becoming available all the time, making more frequent updates not only desirable, but also possible and logical.

Rationale

Jefferson County must update its critical areas maps by December 1, 2004, and its shoreline management plan by December 1, 2011. The City of Port Townsend must update its shoreline management plan by December 1, 2005. Because these critical areas maps and shoreline plans are strong tools for protecting salmon habitat, the Planning Unit should take steps to ensure that the best possible information is available to the County and the City.

Potential Implementers

As mentioned above, a variety of interests could partner to generate this information. A number of agencies could perform the actual stream-typing with assistance from local landowners and the tribes.

Recommendation: Update and revise maps of sensitive areas.

The Planning Unit recommends that its members encourage the formation of a cooperative program of landowners, the Tribes, not-for-profit organizations, Jefferson County, City of Port Townsend, Jefferson County PUD, and the Washington Departments of Natural Resources and Fish and Wildlife to collect field data to verify and improve the sensitive areas maps. This should include seeking funding for adequate stream-typing.

4.3.2.2 Adopt and implement a Stormwater Management Manual

Problem Statement

Urban development causes significant changes in patterns of stormwater flow from land into receiving waters. Water quality can be affected when runoff carries sediment or other pollutants into streams, wetlands, lakes, and marine waters or into ground water.

Description of Option

The Puget Sound Water Quality Action Team's *Puget Sound Water Quality Management Plan* (2000) calls for cities and counties to adopt a Stormwater Management Manual to guide their water quality efforts. Stormwater manuals are one element of comprehensive stormwater management (see Option 4.2.4.2 for more information). The *Management Plan* (Puget Sound Water Quality Action Team, 2000) encourages local governments to adopt the Department of Ecology's *Stormwater Management Manual for Western Washington.* The objective of this manual is to "provide a commonly accepted set of technical standards and guidance on stormwater management measures." The Department Ecology believes that when the standards and recommendations of the manual are properly applied, stormwater runoff should generally comply with water quality standards and protect beneficial uses of the receiving waters (Washington Department of Ecology Water Quality Program, 2001).

Although the manual itself has no independent regulatory authority, Puget Sound's Water Quality Management Plan calls for local governments to adopt the Stormwater Management Manual or an "equivalent" manual (Puget Sound Water Quality Action Team, 2000). Local governments in WRIA 17 may wish to ensure that the manual selected recognizes the predominantly rural character of the watershed.

The 2001 version of Ecology's *Stormwater Management Manual for Western Washington* is appropriate for use throughout Western Washington. It contains a suite of best management practices aimed at cleaning up and controlling stormwater, primarily from new development and redevelopment of commercial, industrial, and residential properties, and road projects (Washington Department of Ecology Water Quality Program, 2001).

Other manuals developed in Washington State include the 1998 King County Surface Water Design Manual, and the Stormwater Manual for Eastern Washington, which is in final draft form (Washington Department of Ecology Water Quality Program, 2003). Although King County is more urbanized than Jefferson County, significant portions of the county are still rural, with agriculture and forestry as primary land uses. King County currently is updating its manual so that it complies with Endangered Species Act requirements, and becomes equivalent to the Ecology manual (King County Water and Land Resources Division, 2003b). The Eastern Washington manual likely is not appropriate for Jefferson County because of climatic differences.

Other options include the US EPA's national best management practices for NPDES Stormwater Phase II, which can be downloaded from their website at http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm. Other states also have developed stormwater manuals or sets of best management practices, including California, Utah, Texas, and Virginia (American Public Works Association, 2003). Like the Eastern Washington manual, however, these manuals may not be appropriate for use in Western Washington due to climatic differences.

Once a manual is selected and adopted, the requirements and technical guidance in the manual can then become required through:

- Ordinances and rules established by local governments; and
- Permits and other authorizations issued by local, state, and federal authorities.

Rationale

By adopting the Stormwater Management Manual or its equivalent, local governments in WRIA 17 could establish shared best management practices for engineers, planners, environmental scientists, plan reviewers, and inspectors in the region. These common best management practices, if implemented, would serve to minimize the effect of development on water quality. Follow-up actions could then include making such practices mandatory through ordinances or through the permitting structure.

Potential Implementers

Cities and counties in WRIA 17 could adopt the Stormwater Management Manual or equivalent manual.

Recommendation: Adopt and implement a Stormwater Management Manual.

The Planning Unit recommends that communities in WRIA 17 adopt the 2001 Ecology Stormwater Management Manual or its equivalent.

4.3.2.3 Enforce existing Jefferson County development regulations

Problem Statement

Jefferson County has adopted and implemented a set of regulations to manage development, including a Comprehensive Plan and the Unified Development Code. The Unified Development Code is the package of specific instructions that allow the County to implement the objectives of the Comprehensive Plan. The Department of Community Development maintains a staff of building inspectors who ensure that construction projects meet the County's building code. However, no staff is available to ensure that new development meets the requirements of the Unified Development Code, which governs critical areas protection, zoning, permit processing, land division, and development and performance standards for a suite of development activities in the County (Jefferson County Department of Community Development, 2003a).

Description of Option

Under this option, Jefferson County would hire code enforcement officer(s) to ensure that new development and redevelopment in the County meets the standards of the Unified Development Code. This code enforcement program would become a basic part of the Department of Community Development's operations.

Rationale

The Jefferson County government and its citizens put a great deal of effort into developing both the Comprehensive Plan and the Unified Development Code. Although most citizens voluntarily comply with regulations, occasionally enforcement is necessary to protect public resources such as salmon habitat. Enforcing these regulations would help protect salmon habitat and likely be simpler than developing new regulations.

Potential Implementers

Jefferson County would be the logical implementer of this option. However, the County will need support from Planning Unit members to help find funding for code enforcement officers, and for monitoring the effectiveness of enforcement.

Recommendation: Continue to enforce Jefferson County development regulations.

The Planning Unit recognizes the need for strong enforcement of Jefferson County's development regulations, and welcomes the County's hiring of an enforcement officer in 2003. The County should continue to monitor the effectiveness of enforcement, and dedicate additional resources to this effort if necessary.

4.3.2.4 Revise critical areas ordinance and shoreline master program

Problem Statement

As described above, RCW 36.70A, the Growth Management Act, requires counties and cities of a certain size or population growth rate to identify critical areas (also known as sensitive areas), which include wetlands, aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geological hazard areas such as hillsides subject to landslides (RCW 36.70A.030). The Growth Management Act also requires Jefferson County to update its plan by December 1, 2004.

Washington adopted the Shoreline Management Act in 1971, which requires local governments to develop shoreline master programs. Shortly thereafter, the Department of Ecology published a set of guidelines to help local governments develop these master programs. In 1995, the Washington Legislature required shoreline management programs to be part of comprehensive plans under the Growth Management Act, and directed Ecology to review and update the guidelines periodically. Ecology began working on this review and update in 1998 (Chehalis River Council, 1998); after a series of drafts and settlement of a lawsuit, new draft guidelines were developed in 2002 (Washington Department of Ecology Shorelands and Wetlands Program, 2003). In conjunction with these new guidelines, the Washington State Legislature amended the timelines for updating these plans. The City of Port Townsend must complete an updated shoreline management plan by December 1, 2005, and Jefferson County must update its plan by December 1, 2011 (SSB 6012).

Jefferson County's critical areas ordinance and shoreline master program both identify and protect sensitive areas, as does the City of Port Townsend's shoreline master program. The requirements to update these regulations provide an opportunity to improve their ability to protect salmon habitat. In addition, the Port of Port Townsend currently is updating their Comprehensive Scheme, providing another opportunity for improved habitat protection.

Description of Option

Both Jefferson County and the City of Port Townsend have shoreline master programs. Under this option, the County and the City would update their shoreline master program, and the County would update its critical areas ordinance. Port Townsend has already begun updating its shoreline master program (Kolff, 2003). The Port of Port Townsend's updates to its Comprehensive Scheme under RCW 53.20 also present another opportunity.

The Growth Management Act requires that jurisdictions use best available science to designate these critical areas and design policies to protect them, and specifies that jurisdictions give special attention to protecting anadromous fisheries (RCW 36.70A.172). Jurisdictions also are required to integrate shoreline master programs and critical areas ordinances such that zoning classifications are consistent with habitat protection needs. This requirement provides the jurisdictions with the opportunity to implement

creative solutions where current zoning and habitat protection requirements are inconsistent. For example, sites that merit additional protection could be designated as "sending" sites in a transfer of development rights program (see option 4.4.1.1). Alternatively, the Planning Unit could contact the owners of those sites to encourage them to participate in the public benefit rating system (option 4.4.1.2), if implemented.

Rationale

The County and the City must update these regulations under state law. This requirement provides the jurisdictions with an opportunity to revise and integrate them such that they protect salmon habitat.

Potential Implementers

Jefferson County and the City of Port Townsend would implement this option.

Recommendation: Update critical areas ordinance and shoreline master programs.

The Planning Unit recommends that Jefferson County and the City of Port Townsend update and integrate their critical areas ordinances and shoreline master programs consistent with best available science to ensure they are protective of water resources and salmon habitat. The frequency of the updates should be consistent with the timelines in state law.

4.3.2.5 Adopt countywide road maintenance standards

Problem Statement

Roads, while necessary for economic development and transportation, can harm aquatic ecosystems. Culverts under roads block or limit passage of both fish and materials such as large woody debris. Roads themselves are impervious surfaces, and thus change surface water runoff patterns. Vehicles shed contaminants on roads, and the contaminants wash into streams. Roads maintenance practices, such as mowing riparian vegetation along roadsides, can degrade aquatic habitat. Lastly, roads built beside streams and rivers restrict channels, cut rivers off from floodplains, and fragment riparian corridors.

Description of Option

A responsible roads maintenance strategy can help reduce the negative effects of roads on aquatic ecosystems and threatened salmon species. Such a strategy should include the identification and repair of fish passage barriers at road crossings.

The Tri-County regional salmon recovery committees developed a roads maintenance strategy that local agencies can use to apply for a take limit from NOAA Fisheries or an elimination or reduction of the standing prohibition against take from the US Fish and Wildlife Service under ESA. In other words, if a local agency follows this program and applies for and receives a take limit from NOAA Fisheries or the USFWS, the agency may conduct its operations without applying for permits for each individual action. The Tri-County Roads Maintenance Program consists of two major parts: regional program elements, and best management practices. Local agencies must implement all ten regional program elements to receive a take limit from NOAA Fisheries or USFWS. The best management practices will help agencies achieve conservation outcomes, and are considered additional to the routine best management practices outlined in the regional program (King County Department of Transportation, 2002).

The regional program consists of the following ten elements:

- Participation in a Regional Forum to share information
- Program review and approval
- Training

- Compliance monitoring
- Scientific research
- Adaptive management
- Emergency response
- Biological data collection
- Biennial reports
- Best management practices and conservation outcomes

Under this option, local agencies could adopt the Tri-County Regional Roads Maintenance Program to ensure that their practices protect and restore aquatic habitat to the extent possible.

Rationale

As described above, roads and roads maintenance practices can harm aquatic habitat. The Tri-County Regional Roads Maintenance Program represents the latest guidance on ways to maintain and repair roads in ways that will protect, and in some cases restore, aquatic habitat.

Potential Implementers

The Jefferson County Public Works Department and the Port Townsend Public Works Department would be the logical implementers of such practices. The Planning Unit should provide support to these two agencies as they seek to adopt this program.

Recommendation: Adopt countywide road maintenance standards.

The Planning Unit recommends that the Jefferson County Public Works Department and the Port Townsend Public Works Department adopt road maintenance standards that protect salmon, such as the Tri-County Roads Maintenance Program. The Planning Unit should provide support to these two agencies as they seek to adopt this program.

4.3.2.6 Transfer regulatory authority over Class IV general forest practices to local governments

Problem Statement

Forests protect salmon habitat by absorbing and slowing runoff and pollutants before they reach streams. Trees and other forest vegetation provide riparian benefits to streams, such as shade, input of nutrients, and contribution of large woody debris.

However, with increasing development pressure comes the incentive to convert forestlands to other uses, such as rural residential development. Currently, the Washington Department of Natural Resources grants permits for timber harvests that precede development, known as Class IV general forest practices (WAC 222-16-050), while local agencies govern zoning and development practices. This system could result in inconsistencies in salmon habitat protections.

Description of Option

Under this option, Jefferson County and the City of Port Townsend would assume responsibility for Class IV general forest practices from the Washington State Department of Natural Resources, as permitted under state law. Jefferson County already plans to amend its Unified Development Code in 2003 so that it contains provisions for reviewing proposals to convert forestlands to other uses (Jefferson County Department of Community Development, 2003b). This transfer of responsibility to the County would

bring this important change in land use together with the County's provisions for protecting sensitive areas and other development regulations.

Rationale

Placing conversion of forestlands under the County's and City's jurisdiction would improve local jurisdictions' ability to protect aquatic habitat, and eliminate the need to consult and coordinate with state agencies.

Potential Implementers

Jefferson County plans to implement this option in 2003. Cities should consider doing so as well.

Recommendation: Transfer regulatory authority over Class IV general forest practices to local governments.

The Planning Unit recommends that Jefferson County and the City of Port Townsend accept regulatory authority over Class IV forest practices, and that future cities in WRIA 17 do so as well. This transfer will aid local governments' ability to protect fish and wildlife habitat.

4.3.2.7 Adopt overlay zones for habitat areas

Problem Statement

Traditional zoning ordinances specify whether lands will be used as residential, commercial, or industrial areas, and provide jurisdictions, landowners, and developers with some certainty and guidance. However, these zones often are not designed to protect habitat.

Description of Option

Under this option, local jurisdictions would adopt overlay zones to protect habitat. Overlay zones are special zones that are placed on top of existing zoning, and that contain regulations that are applied to the properties within the overlay zone in addition to the existing zoning requirements (Garvin, 2001). These overlay zones provide jurisdictions with the opportunity to identify and protect sensitive habitats without placing undue requirements on properties that do not contain such habitats. For example, jurisdictions could adopt overlay zones that protect known spawning areas, class I wetlands, or nearshore feeder bluffs.

Rationale

Overlay zones are a well-known planning tool that jurisdictions can use to protect sensitive areas or to achieve other goals. For example, the City of Portland has used overlay zones to protect more than 19,000 sensitive areas since 1989 (Portland Bureau of Planning, 2002).

Potential Implementers

Jefferson County, the City of Port Townsend, and any future cities in WRIA 17 would implement this option.

Recommendation: None at this time

The Planning Unit did not reach consensus on this option.

4.3.2.8 Establish quasi-governmental districts, such as drainage districts or lake protection districts

Problem Statement

A variety of government agencies, nonprofit organizations, citizens, and businesses are working to protect the environment in WRIA 17. However, most government agencies have a wide range of duties and limited funds with which to accomplish them. State law allows for the creation of special districts that can focus on specific activities and raise their own funds to support these activities.

Description of Option

Under this option, Planning Unit members could encourage the formation of special districts to help protect salmon habitat. RCW 85.38 provides for the establishment and funding of drainage districts in Washington to create and maintain drainage and flood control projects. Jefferson County already has one drainage district, the Port Ludlow Drainage District.

Drainage districts also can include lakes, such as the Lake Stevens Drainage District in Snohomish County, Washington. The Lake Stevens Drainage District pursues a wide variety of activities ranging from basic maintenance of lake outflow channels and drainage conveyances to water quality monitoring, data gathering, and educational activities that support lake and stream restoration projects (Drainage Improvement District No. 8, 2003). One or more special districts in WRIA 17 could undertake similar activities.

Rationale

Formation of a special district with its own funding may help improve coordination and execution of salmon habitat protection and restoration projects.

Potential Implementers

Planning Unit members would work in concert to identify, define, and push for the creation of such a special purpose district.

Recommendation: None at this time

The Planning Unit did not reach consensus on this option.

4.3.3 FUNDING OPTIONS

4.3.3.1 Secure additional federal funding for support of the local Environmental Quality Incentives Program

Problem Statement

The Environmental Quality Incentives Program (EQIP) provides financial assistance to farmers who construct or implement best management practices on their land. Although this program was reauthorized in the 2002 Farm Bill (Natural Resources Conservation Service, 2003), additional funding for the program would broaden its reach.

Description of Option

As described briefly above, EQIP is a federal program run by the Natural Resources Conservation Service that defrays the cost of certain best management practices, such as a livestock fencing, animal waste management, and soil erosion and sediment control (Natural Resources Conservation Service, 2002). To

be eligible, farmers must develop management plans in conjunction with the local conservation district and sign a contract with the Natural Resources Conservation Service for a minimum of one year after the scheduled implementation of the best management practices or a maximum of ten years.

Under this option, the Planning Unit would work with its representatives in the US Congress to direct additional funding to this program. Additional funds could support the implementation of additional farm management plans that control harmful manure and nutrient runoff.

Rationale

Farming is an important part of the WRIA 17 culture, landscape, and economy. This program helps to support both agricultural production and salmon habitat.

Potential Implementers

As described above, the Planning Unit should work together to lobby its US Congress representatives to secure more funding for this program. The Planning Unit may consider partnering with agricultural interests, other WRIAs, and local and national environmental groups to strengthen its case.

Recommendation: None at this time

The Planning Unit believes that lobbying Congress is beyond the scope of the watershed planning process.

4.3.3.2 Secure a permanent, stable revenue stream for correction of fish passage barriers

Problem Statement

Fish passage barriers limit the recovery of salmon statewide, and are particularly a problem in east Jefferson County. Barriers prevent fish from reaching habitat suitable for spawning, rearing, or hiding from predators, forcing them to use less suitable habitats and exposing them to predation risks. Public agencies are required to repair publicly owned fish passage barriers, such as culverts under private roads. However, a stable revenue source for such repairs is not available.

Description of Option

Under this option, the WRIA 17 Planning Unit should work with other planning units and local government associations such as the Association of Washington Cities to lobby the state and/or federal governments to establish such a revenue stream. Creative thinking will be necessary to identify a source for such funding, particularly in times of budget crunches. However, fixing these barriers should be a high priority for salmon recovery, and thus should merit some attention in Olympia.

In addition, the Planning Unit may wish to consider developing incentive programs to entice private landowners to repair culverts on their property. Incentives such as property-tax breaks or partial cost defrayment may be popular with property owners, but may also require additional sources of funding. In addition, jurisdictions should publicize the repair of public fish passage barriers to elevate public awareness of this issue, and to draw attention to the problem of privately owned barriers.

Rationale

Fish passage barriers are a limiting factor in east Jefferson County. Although governments must repair publicly owned barriers, no stable funding sources is available to support this work. Without funding, barriers will remain.

Implementation

As noted above, the WRIA 17 Planning Unit should collaborate with other planning units and organizations such as the Association of Washington Cities to create a cohesive and powerful lobbying effort.

Recommendation: Secure a permanent, stable revenue source to maintain adequate fish passage.

The Planning Unit recommends that its members collaborate with other planning units and organizations to create a stable revenue source for correcting public fish passage barriers and maintaining clear passage. The Planning Unit recommends that impassable culverts be replaced as soon as funding is secure, in coordination with local road planning efforts.

4.3.3.3 Explore other revenue sources for habitat conservation

Problem Statement

Although grant programs and cost-sharing programs exist to help defray the costs of habitat conservation, additional funding will be required to implement all actions necessary to restore salmon runs in WRIA 17.

Description of Option

One option to pursue is the real estate excise tax. RCW 82.46.070 authorizes counties to levy an additional real estate excise tax on each sale of real property at a rate of up to one percent of the selling price. A majority of voters in the county must approve this levy, which is paid by the buyer rather than the seller. Funds from this tax must be spent upon the acquisition and maintenance of conservation areas, and therefore are very well suited to protecting and restoring salmon habitat. San Juan County is the only county to have implemented this tax (Municipal Research and Services Center of Washington, 2002).

Rationale

Traditional sources of revenue are not sufficient to support all necessary salmon habitat restoration projects. The additional real estate excise tax is an option that is already authorized under state law, and that is focused upon the acquisition and maintenance of conservation areas.

Implementers

Although state law allows only counties to implement this tax, all Planning Unit members would need to support this option to encourage voters to adopt it.

Recommendation: Pursue other funding and revenue options.

The Planning Unit recommends that its members should consider all feasible funding options to implement the plan.

4.3.4 COOPERATIVE OPTIONS

4.3.4.1 Support the Hood Canal Coordinating Council's salmon habitat planning efforts and investigate creative, collaborative restoration opportunities

Problem Statement

The degradation of both terrestrial and aquatic habitats on the Olympic Peninsula and around Puget Sound resulted in the listing of Hood Canal summer chum, Puget Sound chinook, and Puget Sound bull trout under the Endangered Species Act.

Description of Option

These listings have prompted renewed focus on protecting and restoring salmon habitat. As Lead Entity, the Hood Canal Coordinating Council (HCCC) is developing a salmon habitat recovery strategy that outlines habitat restoration actions needed to support recovery of at-risk salmonid stocks in WRIA 17 and across Hood Canal and the eastern Strait of Juan de Fuca. The WRIA 17 Planning Unit supports the HCCC salmon recovery strategy process as the primary non-regulatory planning vehicle for enhancing freshwater and estuarine habitat conditions for salmon in the WRIA. The WRIA 17 Planning Unit also supports the efforts of a variety of agencies and organizations to implement salmon habitat improvement and protection projects.

The HCCC is also developing a salmon recovery plan, which will provide a comprehensive approach towards the recovery of summer chum salmon in the Hood Canal/Eastern Strait of Juan de Fuca ESU. The summer chum salmon recovery plan will be coordinated with the efforts of the WRIA 17 Planning Unit as appropriate.

Rationale

As the Lead Entity for the Hood Canal watershed, the Hood Canal Coordinating Council has taken the lead in developing protection and restoration projects to stem the decline of salmonids on the Olympic Peninsula. The HCCC will also provide a comprehensive approach towards the recovery of the ESA-listed summer chum salmon. The WRIA 17 Planning Unit supports these efforts and seeks to avoid duplication. A variety of agencies and organizations have been and continue to be actively involved in implementing salmon habitat improvement and protection projects, as well as the Hood Canal Coordinating Council strategy process.

Potential Implementers

All member organizations of the Planning Unit may have a role in implementing the HCCC salmon recovery strategy. In addition, organizations across Hood Canal and the Strait of Juan de Fuca, including state and federal agencies, will need to participate to implement this strategy successfully.

Recommendation: Support the Hood Canal Coordinating Council's salmon habitat restoration efforts.

The Planning Unit recommends that all member organizations of the Planning Unit take a role in developing and implementing the HCCC salmon restoration strategy. The WRIA 17 Planning Unit supports the HCCC process and seeks to avoid duplicating this effort.

Chapter 5: Recommendations

Recommendations

This chapter summarizes the WRIA 17 Planning Unit's recommendations for protecting and enhancing water quantity, water quality, instream flows, and habitat in the watershed. Most of these recommendations were developed in response to the options presented in Chapter 4. However, the Planning Unit developed some recommendations without the need for additional analysis of the options. Therefore, additional detail about most of these recommendations can be found in Chapter 4.

WATER QUANTITY RECOMMENDATIONS

1. Prepare and implement water conservation plans

The Planning Unit recommends that water purveyors and major water users in the WRIA prepare and implement water conservation plans. Incentive-based water conservation programs should be considered in the plans. Examples of incentive-based conservation programs include tiered rate structures, summer surcharges, rebates on water-efficient appliances—especially toilets, and offers of free or discounted water-saving devices, such as low-flow shower heads. Water conservation plans should also include education and outreach programs. (For more information, please see Option 4.1.1.1 on page 55.)

2. Increase public awareness and education on water use

The Planning Unit recommends that all Planning Unit members collaborate to develop public education programs about water use. Two examples of strategies include charting individual water use on utility bills, and launching an education and promotion campaign. (For more information, please see Option 4.1.1.3 on page 58.)

3. Coordinate regional drought contingency and system security planning

The Planning Unit recommends that water purveyors develop and coordinate drought contingency plans that consider inter-ties and conjunctive use in the event of extreme drought or contamination. (For more information, please see Option 4.1.2.2 on page 59.)

4. Participate in water rights acquisition programs

The Planning Unit recommends that local governments and conservation organizations provide assistance to water-right holders who wish to participate in water-rights acquisition programs on a temporary or permanent basis. (For more information, please see Option 4.1.4.1 on page 62.)

5. Protect critical aquifer recharge areas and wellhead protection zones

The Planning Unit recommends that Jefferson County define and delineate aquifer recharge areas and wellhead protection zones. Jefferson County extends property tax incentives to landowners who leave

these areas forested or undeveloped. Jefferson County should regularly update zoning and development regulations to ensure these areas are protected. Water purveyors, Jefferson County, or Jefferson Land Trust could acquire property titles or development rights to these areas. (For more information, please see Option 4.1.4.3 on page 64.)

6. Better implement water-metering and reporting requirements in the WRIA

The Planning Unit recommends that Planning Unit members assist the Washington Department of Ecology with implementing water metering and reporting requirements. This assistance could take the form of technical assistance or other support. (For more information, please see Option 4.1.5.1 on page 65.)

7. Facilitate compliance with existing laws and regulations regarding illegal water withdrawals

The Planning Unit recommends that the state legislature fully fund the Department of Ecology's enforcement operations to stop illegal water withdrawals. Ecology should work with Planning Unit members to initiate actions to bring those who are illegally withdrawing water into compliance. (For more information, please see Option 4.1.3.2 on page 61.)

8. Identify where existing laws constrain wise water use and promote changes to these laws

The Planning Unit recommends that its members work to build support for reforming Washington water law so that it promotes wise water use. Examples of potential changes include providing an ongoing mechanism to eliminate disincentives to conservation, allowing orderly transfer of conserved water to instream flow needs or other beneficial uses, allowing water storage from residential rain water catchments, modifying plumbing standards, and reducing the daily withdrawal limit on exempt wells. (For more information, please see Option 4.1.3.1 on page 60.)

WATER QUALITY RECOMMENDATIONS

9. Continue Conservation District program with landowners

The Planning Unit recommends that the Jefferson County Conservation District continue its successful work with landowners to help them implement conservation practices that protect and improve water quality. The District also should continue its water quality monitoring program to track the success of these conservation measures. Funding for Conservation District educational programs, such as the "Horses for Clean Water" program, should continue. (For more information, please see Option 4.2.2.1 on page 71.)

10. Protect and restore riparian vegetation

The Planning Unit recommends that member organizations work to protect and restore riparian vegetation. Specifically, the Jefferson County Conservation District should continue its work with landowners through programs such as the Conservation Reserve Enhancement Program (CREP). Jefferson County should continue its Conservation Futures grant program and focus part of the funds on acquiring and/or protecting riparian areas. The County also should enforce provisions of the Unified Development Code that protect riparian buffers. Lastly, the Planning Unit encourages the Jefferson Land Trust to continue its work with landowners, JCCD, and NOSC to identify and develop conservation easements on riparian areas. These implementers should continue to work together to ensure that protection and improvement of riparian areas is coordinated and effective. (For more information, please see Option 4.2.2.2 on page 72.)

11. Reduce pesticide and herbicide use

The Planning Unit recommends that Planning Unit members implement one or more of the following programs to reduce pesticide use:

- Provide education, outreach, and technical assistance to pesticide users;
- Develop certification programs and market incentives;
- Establish a Pest Management Policy; and/or
- Ban or restrict the use of pesticides.

(For more information, please see Option 4.2.2.3 on page 73.)

12. Reduce use and release of synthetic organic compounds

The Planning Unit recommends that local governments and industries work together to identify synthetic organic compounds, find ways to dispose them safely, and develop alternatives to these products. Planning Unit member organizations could encourage the state to ban or phase out specific synthetic organic compounds. (For more information, please see Option 4.2.2.4 on page 75.)

13. Implement a surface and ground water quality monitoring plan

The Planning Unit recommends that a surface and groundwater monitoring plan is implemented. This plan will help coordinate the monitoring efforts of a wide variety of agencies in the watershed. (For more information, please see Option 4.2.4.1 on page 77.)

14. Encourage water quality monitoring

The Planning Unit recommends that Planning Unit members and other institutions/ organizations encourage and, if feasible, provide financial support for local citizen groups to conduct water quality monitoring programs that use citizen volunteers to collect data in a manner consistent with the protocols established in the Water Quality Monitoring Plan. Examples of such programs are the Pacific Ecological Institute's project on Leland Creek and the Jefferson County Conservation District's program with Chimacum School's hydrology class, Wild Olympic Salmon, and other volunteers. These programs must

be coordinated with government agencies to ensure that the data collected are useful. (For more information, please see Option 4.2.3.1 on page 76.)

15. Work with state agencies to upgrade water quality data accessibility

The Planning Unit recommends that its members encourage the Washington Department of Health and other state agencies to determine local data needs, and identify and develop a useable water quality database. These updates should include adding the Department of Ecology's unique well number to each database record. (For more information, please see Option 4.2.5.2 on page 82.)

16. Adopt surface water and/or stormwater management plans

The Planning Unit recommends that Jefferson County and the City of Port Townsend develop surface water and/or stormwater management plans that describe how water quality and water resources will be protected and restored. Port Townsend and Port Ludlow already collect fees to treat and manage stormwater, and should continue their efforts. (For more information, please see Option 4.2.4.2 on page 78.)

17. Adopt Stormwater Management Manual

The Planning Unit recommends that communities in WRIA 17 adopt the 2001 Ecology Stormwater Management Manual or its equivalent. (For more information, please see Option 4.2.4.3 on page 80.)

18. Provide public education for water quality

The Planning Unit recommends that Planning Unit members support the water quality education efforts of not-for-profit organizations, local citizen groups, and academic groups. Existing education programs include those related to reduction of impacts on water quality from human activities, and natural systems within the watershed and water-related needs of fish and wildlife. Examples of public education programs for water quality include WSU Extension's Realtor Education Seminars and Olympic Peninsula Water Watcher trainings and projects, 4H Natural Resources Program, the Marine Science Center programs, NOSC trainings and restoration projects, and the Conservation District's landowners programs. Water quality education partnerships with local schools and youth groups should be encouraged. In support of these efforts, Planning Unit members are encouraged to provide materials, supplemental funding, or donated time to train volunteers.

19. Compile and track public outreach and education programs

The Planning Unit recommends that a Planning Unit member or other agreed upon organization compile and track a list of public education programs being provided by local organizations. This list would be used to continue to document and evaluate public education efforts and to identify gaps in water quality public education.

HABITAT RECOMMENDATIONS

20. Support the Hood Canal Coordinating Council's salmon habitat restoration efforts

The Planning Unit recommends that all member organizations of the Planning Unit take a role in developing and implementing the HCCC salmon restoration strategy. The WRIA 17 Planning Unit supports the HCCC process and seeks to avoid duplicating this effort. (For more information, please see Option 4.3.4.1 on page 102.)

21. Utilize the Limiting Factors Analysis and Refugia Study to guide habitat restoration activities

The Planning Unit recommends that Planning Unit members use the Limiting Factors Analysis and the East Jefferson County Refugia Study in guiding habitat restoration activities.

22. Support local salmon recovery efforts

The Planning Unit recommends that the coordinated salmon recovery efforts by organizations such as North Olympic Salmon Coalition, Conservation District, Jefferson Land Trust, Wild Olympic Salmon, Trout Unlimited, Hood Canal Salmon Habitat Enhancement Group, local Treaty Tribes, WDFW and other entities be supported and continued. These organizations working together have been very successful in improving and protecting salmon habitat and salmon stocks. Successful implementation of the HCCC salmon recovery strategy at the local level will depend on these groups.

23. Advocate for changes to the Conservation Reserve Enhancement Program

The Planning Unit recommends that its members should join with other planning units, agricultural interests, environmental groups, and others to form a coordinated effort to lobby for changes to the Conservation Reserve Enhancement Program (CREP). Specifically, these changes should include providing adequate funding, indefinite leases when landowners are interested, and expanding CREP to other streams that are currently ineligible. (For more information, please see Option 4.3.1.5 on page 90.)

24. Conserve instream wood, formalize large wood stockpiling efforts, and collaborate on education

All Planning Unit members should collaborate on an education effort to heighten public awareness of the importance of conserving large woody debris in streams whenever possible. The Planning Unit recommends that governmental agencies make the large woody debris stockpiling part of their normal operations. (For more information, please see Option 4.3.1.6 on page 90.)

25. Update and revise maps of sensitive areas

The Planning Unit recommends that its members encourage the formation of a cooperative program of landowners, the Tribes, not-for-profit organizations, Jefferson County, City of Port Townsend, Jefferson County PUD, and the Washington Departments of Natural Resources and Fish and Wildlife to collect field data to verify and improve the sensitive areas maps. This should include seeking funding for adequate stream-typing. (For more information, please see Option 4.3.2.1 on page 91.)

26. Adopt and implement a Stormwater Management Manual

See Recommendation 17 in the water quality section.

27. Adopt countywide road maintenance standards

The Planning Unit recommends that the Jefferson County Public Works Department and the Port Townsend Public Works Department adopt road maintenance standards that protect salmon, such as the Tri-County Roads Maintenance Program. The Planning Unit should provide support to these two agencies as they seek to adopt this program. (For more information, please see Option 4.3.2.5 on page 96.)

28. Continue to enforce Jefferson County development regulations

The Planning Unit recognizes the need for strong enforcement of Jefferson County's development regulations, and welcomes the County's hiring of an enforcement officer in 2003. The County should continue to monitor the effectiveness of enforcement, and dedicate additional resources to this effort if necessary. (For more information, please see Option 4.3.2.3 on page 94.)

29. Transfer regulatory authority over Class IV general forest practices to local governments

The Planning Unit recommends that Jefferson County and the City of Port Townsend accept regulatory authority over Class IV forest practices, and that future cities in WRIA 17 do so as well. This transfer will aid local governments' ability to protect fish and wildlife habitat. (For more information, please see Option 4.3.2.6 on page 97.)

30. Secure a permanent, stable revenue source to maintain adequate fish passage

The Planning Unit recommends that its members collaborate with other planning units and organizations to create a stable revenue source for correcting public fish passage barriers and maintaining clear passage. The Planning Unit recommends that impassable culverts be replaced as soon as funding is secure, in coordination with local road planning efforts. (For more information, please see Option 4.3.3.2 on page 100.)

31. Expand citizen-based salmon habitat programs

The Planning Unit encourages not-for-profit organizations and citizen groups to address salmon habitat issues. For example, Washington State University is encouraged to expand the Water Watcher's Program to include more salmon habitat issues. In addition, Wild Olympic Salmon, North Olympic Salmon Coalition, Trout Unlimited, and others are encouraged to continue their habitat restoration efforts through ongoing coordinated efforts as well as by developing new partnerships. In support of these efforts, Planning Unit members are encouraged to provide materials, supplemental funding, or donated time to train volunteers. (For more information, please see Option 4.3.1.4 on page 89.)

32. Support the Washington Water Acquisition Program

The Planning Unit recommends that its member organizations work together to promote and support the Washington Water Acquisition Program. Ideas include conducting outreach to farmers and industries that are interested in water conservation, developing a presentation and giving it to community groups, and considering conservation banking. (For more information, please see Option 4.3.1.3 on page 87.)

33. Investigate a transfer of development rights program (TDR)

The Planning unit recognizes the value of TDR programs as a planning tool and recommend Jefferson County and the City explore the possibility of establishing a TDR program in the WRIA. State agencies should be encouraged to fund these efforts by local governments through grants or other funding sources. (For more information, please see Option 4.3.1.1 on page 84.)

34. Provide public education about the value of healthy habitats and the importance of habitat restoration efforts.

The Planning Unit recommends that its members encourage and support the habitat public education and restoration programs of local not-for-profit organizations, citizen and academic groups. Member support could include providing materials, supplemental funding, donated time, and assistance in procuring grant funds. Habitat education partnerships with local schools and youth groups should be encouraged.

35. Compile and track public outreach and education programs

The Planning Unit recommends that a Planning Unit member or other agreed upon organization compile and track a list of public education programs being provided by local organizations. This list would be used to continue to document and evaluate habitat-related public education efforts and to identify gaps in habitat-related public education.

INSTREAM FLOW RECOMMENDATIONS

36. Adopt instream flows

The Planning Unit is in the process of conducting additional work in order to gather technical information for considering instream flows. The Planning Unit should continue its efforts to gather information and reach a consensus recommendation for instream flows. As part of the process, the Planning Unit should also review the technical basis for the instream flow recommendations in the Dungeness-Quilcene Water Resources Plan and WDFW Policy 5204. The Planning Unit also recommends that Ecology continue to work collaboratively with the Planning Unit per RCW 90.82.080 in an attempt to achieve consensus and approval of instream flows to be adopted by Ecology.

OVERARCHING RECOMMENDATIONS

37. Pursue other funding and revenue options

The Planning Unit recommends that its members should consider all feasible funding options to implement the plan. (For more information, please see Option 4.3.3.3 on page 101, and Option 4.2.1.2 on page 70.)

38. Coordinate planning across numerous agencies

The WRIA 17 Planning Unit recommends that coordinated planning continue among a variety of agencies, including local planning commissions, the Jefferson County PUD #1, the Jefferson County Water Resources Council, the Jefferson County Marine Resources Committee, the Hood Canal Coordinating Council, and area tribes. (For more information, please see Option 4.2.5.1 on page 81.)

39. Improve the sharing of existing information and data gathering

The Planning Unit recommends that its member organizations and other interested parties improve and expand existing information and data gathering efforts. (For more information, please see Option 4.1.5.2 on page 66.)

40. Update critical areas ordinance and shoreline master program

The Planning Unit recommends that Jefferson County and the City of Port Townsend continue to update and integrate their critical areas ordinances and shoreline master programs consistent with best available science to ensure they are protective of water resources and salmon habitat. The frequency of the updates should be consistent with the timelines in state law. (For more information, please see Option 4.3.2.4 on page 95.)

41. Adjust boundary line between WRIA 17 and WRIA 18

The Planning Unit recommends that the Washington Department of Ecology develop criteria to consider boundary-line adjustments between Water Resource Inventory Areas 17 and 18 to include Sequim Bay

and the independent drainages in Clallam County within the boundary of WRIA 18. This adjustment would more closely align with county boundaries and therefore allow for a better-coordinated watershed management effort.

The Planning Unit would also like to explore changing the boundary between WRIA 17 and WRIA 16 to include the drainages of the Dosewallips and Duckabush Rivers in WRIA 17. This adjustment would improve opportunities for effective public participation.

42. Improve communication with the public

The Planning Unit recommends that there is improved communication with the public on water issues. As a coordinated effort, Planning Unit members should ensure that such communication occurs through a newsletter, newspaper ads or articles, or other means. The specific communication strategy should be included in the plan implementation strategy adopted by the Planning Unit meeting following plan adoption.

43. Amend or update Watershed Plan

The Planning Unit recommends that, in the absence of state legislative action, the following process be used to amend or update the Plan:

- Any Planning Unit member may offer an amendment or update to the Plan.
- The proposed amendment or update will be discussed at one Planning Unit meeting, and voted on at a future Planning Unit meeting.
- The voting process will follow the consensus requirements identified in RCW 90.82.
- The Jefferson County Board of Commissioners will have 60 days in which to approve or reject the amendment or update.

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Appendix 1: Watershed Plan Implementation

Watershed Plan Implementation

INTRODUCTION

This appendix presents information to guide government agencies, tribes, educational institutions, businesses, environmental organizations, individuals, and other stakeholders as they implement the recommendations in this Watershed Management Plan. This information is intended for use only as general guidelines for planning purposes; a detailed Implementation Plan may be developed in Phase IV of the watershed planning process. This appendix begins with an overview of federal, state, local, and tribal regulations that affect water resource management in WRIA 17. Next, the appendix summarizes the current water resource management efforts of a number of local non-profits, government agencies, and other institutions, based on information submitted to the consultant. Lastly, the appendix includes a matrix showing which entities are responsible for implementing which recommendations.

REGULATORY FRAMEWORK

The WRIA 17 Watershed Management Plan was not developed in a vacuum. As the Planning Unit brainstormed options and selected recommendations to address water resource management issues in the watershed, members considered the extensive framework of federal, state, and local regulations, as well as tribal treaty rights, that already govern these issues. Understanding this framework is essential to understanding the context within which this Plan will be implemented.

The tables that follow describe these regulations and treaty rights, and the obligations that they place on government agencies and others. Much of the information about federal and state laws is adapted from Appendix C of the WRIA 8 Near-Term Action Agenda [Lake Washington/Cedar/Sammamish Watershed (WRIA 8), 2002].

Federal Laws

Several well-known federal regulations affect water resource management in WRIA 17, including the Clean Water Act, the Endangered Species Act, and the National Environmental Policy Act. These and other laws are described in Table 6.

Table 6: Federal Laws Affecting Water Resource Management in WRIA 17

Federal Law	Affected Agencies	Responsibilities
Clean Water Act (CWA) The primary federal law that protects the nation's waters, including coastal areas. The two fundamental goals of the CWA are to eliminate the discharge of pollutants into the nation's waters, and to achieve water quality levels that are fishable and swimmable.	Environmental Protection Agency (some authorities delegated to the Washington Department of Ecology)	Charged with implementing most of the CWA, including Section 303 (water quality standards and TMDLs) and Section 402 (NPDES permitting).
	US Army Corps of Engineers	Charged with implementing Section 404 (dredge and fill permitting)

Federal Law	Affected Agencies	Responsibilities
Endangered Species Act (ESA) Provides protection for species of insects, animals, and plants in the United States that are listed as needing protection. When a species is listed under ESA, "critical habitat," or habitat containing physical or biological features essential to the species' conservation, is designated. Federal agencies are prohibited from authorizing funding for or carrying out any action that will result in the destruction or adverse modification of critical habitat.	NOAA Fisheries (formerly known as the National Marine Fisheries Service, or NMFS)	Responsible for listing and protecting marine species, including anadromous fish.
	US Fish and Wildlife Service	Responsible for listing and protecting freshwater and terrestrial species.
National Environmental Policy Act (NEPA) Designed to "encourage productive and enjoyable harmony between man and his environment; promote efforts to prevent or eliminate damage to the environment and biosphere; and enrich the understanding of the ecological systems and natural resources important to the nation."	All federal agencies	Must analyze the environmental effects of a proposed major federal action, using input from state and local governments, tribes, the public, and other federal agencies (Council on Environmental Quality, 1997)
	White House Council on Environmental Quality	Reviews and appraises all federal agencies' programs and activities. Determines whether the objectives of NEPA are being achieved, and documents changes in the natural environment.
Coastal Zone Management Act (CZMA) Adopted to encourage and assist the states in developing and implementing management programs that preserve, protect, and where possible, restore or enhance the resources of the nation's coastal zone. Requires that federal agencies or their licensees carry out their activities to conform to each state's coastal zone management program.	Department of Commerce	Assists states with developing and implementing coastal zone management plans. A host of programs have been developed at the federal level to provide this assistance, including grants to states and federal-state partnerships. Manages the National Estuarine Research Reserve Program, also authorized under CZMA.

State Law

Similarly, a host of state laws affect water resource management in Washington State. The Watershed Planning Act enables groups like the WRIA 17 Planning Unit to conduct watershed planning, while the

State Water Code governs water rights. These and other state regulations are described in Table 7, below.

Table 7: State Laws Affecting Water Resource Management in WRIA 17

State Law	Affected Agencies	Responsibilities
Watershed Planning		
Watershed Planning Act (RCW 90.82, also referred to as 2514) Enables counties, cities, and water utilities, in cooperation with Indian Tribes with reservations in the management area, to form WRIA planning units and to receive state funding for watershed planning. Watershed plans developed under RCW 90.82 must address water quantity, and may address water quality, instream flows, and habitat. The plans must not conflict with existing state statutes, federal laws, or tribal treaty rights, or impair existing water rights. Participating entities are obligated to implement plan recommendations.	Department of Ecology	Administers grants and participates in watershed planning efforts.
	Other state agencies	Must provide technical assistance to WRIA Planning Units if the Planning Units request it.
	Local governments	Decide whether to initiate watershed planning. All counties, the largest city or town, and the largest water supply utility in the WRIA must agree to pursue watershed planning, and invite all tribes with reservation lands within the WRIA to participate.
Water Resources Act (RCW 90.54) Outlines water resource policies and provides guidance to local governments in comprehensive water resource planning. The statute emphasizes cooperation and coordination among local governments, the state, and federally recognized Indian tribes. Policy guidelines in the statute are largely advisory.	Department of Ecology	Reviews existing state laws to be sure they don't conflict with water resources priorities established in RCW 90.54. Evaluates the need for water resources projects and analyzes ways to fund them. Can recommend land use policy changes to state agencies, local governments, and others, if such changes would promote the state's water resources policies.
	Local governments	Local governments are directed to explore all possible measures for the protection of groundwater aquifers that are the sole source of drinking water within a jurisdiction.

State Law	Affected Agencies	Responsibilities
Water Quantity		
State Water Code (RCW 90.03) First enacted in 1917, this code establishes that the state's water policy is to derive maximum net benefits from both diversionary uses of water and retention of water within stream and lakes, and to reduce wasteful uses of water. It also reaffirms the policy of "first in time, first in right" regarding appropriation of water rights, and "use it or lose it." This code also sets forth processes to determine water rights, and to apply for new water rights.	Department of Ecology	Processes applications for new water rights, water-rights transfers, and water-rights changes, and participates in water-rights adjudication processes.
Regulation of Public Ground Waters (RCW 90.44) Enacted in 1945, this code requires users of ground water to obtain certificates of rights to that water. This code exempts ground water used for stock watering, domestic uses up to 5,000 gallons per day or a half-acre of non-commercial irrigation, and industrial uses up to 5,000 gallons per day. The code also directs Ecology to ensure that ground water is not wasted.	Department of Ecology	Processes applications for new water rights, water-rights transfers, and water-rights changes, and participates in water-rights adjudication processes.
Water Well Construction (RCW 18.104) Established in 1971 and later amended, this section of the state code establishes that the drilling, making, and constructing of wells in Washington are activities of vital public interest. The code provides for regulation of well operators and contractors in addition to well design and construction to protect public health, welfare, and safety. This provision allows for regulation of well drilling, including exempt wells.	Department of Ecology	Regulates and licenses well drilling contractors. Regulates all aspects of well construction, including limitations on well drilling where needed to protect water resources.
	Other state agencies	Department of Health and other agencies must provide technical advice to Ecology if requested.
	Local governments	If a county or local health district requests, Ecology may delegate the authority to administer and enforce well construction and tagging.

State Law	Affected Agencies	Responsibilities
Claims Registration Act (RCW 90.14) This law established two periods during which citizens could file claims to water rights: ▪ July 1, 1967 to June 30, 1974 ▪ September 1, 1997 to June 30, 1998 In addition, this code establishes the policy of "use it or lose it," or relinquishment of water rights that are unused for five consecutive years after July 1, 1967.	Department of Ecology	Processes water-rights claims
Water Quality		
Water Pollution Control Act (RCW 90.48) First enacted in 1973, this act is the state's companion to the federal Clean Water Act. It establishes a state policy of maintaining the highest possible standards of water quality, and gives the Department of Ecology jurisdiction over pollution control and prevention. This code covers sewage treatment, waste disposal permits, aquatic weed control, and other aspects of water quality.	Department of Ecology	Regulates all aspects of pollution control and prevention in the state's waters. Designated as the State Water Pollution Control Agency for all purposes of the federal Clean Water Act, including developing TMDLs.

State Law	Affected Agencies	Responsibilities
Instream Flows		
Minimum Water Flows and Levels (RCW 90.22) Allows the Department of Ecology to establish minimum water flows or levels for streams, lakes, or other public waters for the purposes of protecting fish, game, birds or other wildlife resources; other recreational or aesthetic values whenever it appears to be in the public interest to do so. The Department of Fish and Wildlife can request that Ecology set flows to protect fish, game, or other wildlife resources. Ecology also can set flows if it finds them necessary to protect water quality.	Department of Ecology	Sets instream flows to protect wildlife, water quality, recreation, or aesthetics. (Note that the Watershed Planning Act allows WRIA Planning Units to work with Ecology to develop instream flows by consensus for water bodies where no instream flows have been set by rule. If the Planning Unit recommends such an instream flow, the Department of Ecology adopts the recommendation by rule. If the Planning Unit does not recommend flows, Ecology may establish flows.)
Habitat and Salmon Recovery		
Washington State Salmon Recovery Act (RCW 77.85, also referred to as 2496 or 5595) Creates a coordinated framework of salmon-recovery planning within Washington State through the establishment of the Governor's Salmon Recovery Office, the Independent Science Panel, and the Salmon Recovery Funding Board. Also provides grant funding for habitat restoration and protection projects.	Governor's Salmon Recovery Office	Coordinates state strategy for salmon recovery, especially the development of salmon recovery plans for each evolutionarily significant unit (ESU). Also submits the biennial *State of the Salmon Report* to the legislature.
	Independent Science Panel	Ensures that sound science is used in recovery planning, recommends standard monitoring indicators and data-quality guidelines.
	Salmon Recovery Funding Board	Makes grants and loans for salmon habitat projects and salmon recovery activities
	Local governments and partners such as tribes, business and environmental interests, water/sewer districts, and other stakeholders	Local governments and tribes must select a Lead Entity, who creates a citizen-based committee to review proposed salmon projects. This committee recommends projects to the SRF Board for funding. Each Lead Entity oversees a WRIA or multi-WRIA area.

State Law	Affected Agencies	Responsibilities
Growth Management Act (GMA, RCW 36.70A) The Washington State Legislature found that uncoordinated and unplanned growth threatened the environment and sustainable economic development. It therefore established a process for citizens, local government, and the private sector to cooperate in and coordinate comprehensive land use planning and zoning. The GMA establishes goals and policy direction on a wide range of issues, including environmental protection and shoreline management.	Local governments	Counties and cities of a certain size or growth rate must develop growth management plans that designate critical areas, agricultural lands, forestlands, and mineral resource lands, and adopt development regulations to conserve and protect them. The act also requires jurisdictions to update these plans on a regular schedule. Jefferson County must update its plan by December 1, 2004, and every seven years thereafter.
Shoreline Management Act (SMA, RCW 90.58) Designed to manage and protect the shorelines of the state by regulating development in the shoreline area. A major goal of the act is to "prevent the inherent harm of an uncoordinated and piecemeal development of the state's shorelines." The SMA also states that shorelines should be managed to foster all reasonable and appropriate uses and to ensure uses are designed and conducted in a manner that minimizes damage to the ecology and environment. Amendments to SMA in 1995 made Shoreline Master Programs part of comprehensive plans developed under the Growth Management Act.	Department of Ecology	Develops guidelines for local governments to follow in developing local Shoreline Master Programs. Supports development of these local programs, and reviews and approves completed Shoreline Master Programs.
	Local governments	Must develop Shoreline Master Programs and administer shoreline permits.

State Law	Affected Agencies	Responsibilities
State Environmental Policy Act (SEPA, RCW 43.21C) Directs state agencies to use all practicable means and measures to create and maintain conditions under which people and nature can exist in productive harmony. Requires that state agencies analyze the environmental impacts of their proposed actions. This analysis is intended to coordinate with permit reviews. Amendments to SEPA in 1997 integrated SEPA requirements with those of the Growth Management Act.	All state, county, and city agencies	State and local governments must prepare environmental impact statements that analyze the effects of their proposed actions.
Aquatic Lands Act (RCW 79.90) Finds that state-owned tidelands are a finite resource of great value. States that aquatic lands are to be used to provide a balance of public benefits for all the state's citizens, including encouraging direct public use and access, and ensuing environmental protection.	Department of Natural Resources	Must authorize any activity that interferes with the public's use of state-owned tidelands. Manages tidelands, with emphasis on protecting areas of statewide implications and/or benefits. Identifies these through the Shoreline Management Act.

Local Laws and Regulations

Local governments in WRIA 17 also have established regulations that affect water resource management, largely in response to state laws. Table 8 shows which local governments have adopted plans and codes, and how they relate to the state laws.

Table 8: Local Laws and Regulations Affecting Water Resource Management in WRIA 17

Local Law or Regulation	Consistent With
Jefferson County	
Unified Development Code	• Growth Management Act • Shoreline Management Act • Clean Water Act
Comprehensive Plan	• Growth Management Act • Endangered Species Act

City of Port Townsend	
Comprehensive Plan	Growth Management Act
Shoreline Master Program	Shoreline Management Act
Draft Storm Water Management Plan	Clean Water Act
Port of Port Townsend	
Comprehensive Scheme	RCW 53.20 (Harbor Improvements)

Tribal Treaties and Regulations

Lastly, tribal treaties and related decisions affect watershed planning, particularly the habitat or salmon-recovery aspects. These treaties are described in Table 9. The Jamestown S'Klallam Tribe has reservation lands in WRIA 17, as well as usual and accustomed fishing areas (Chitwood, 2003). The Skokomish Tribe, the Port Gamble S'Klallam Tribe, the Lower Elwa S'Klallam Tribe, and the Suquamish Tribe also have usual and accustomed fishing areas in WRIA 17 (Labbe, 2003).

Table 9: Tribal Treaties and Regulations Affecting Water Resource Management in WRIA 17

Tribal Treaty or Related Case Law	Effect
Fishing Rights and Habitat	
Point No Point Treaty of 1855	Established reservations for the tribes, ceded other tribal lands to the United States, and established the tribes' right to fish in usual and accustomed grounds and stations.
Boldt Decision, or *Washington v. Fishing Vessel Association (1979)*	This federal court case re-affirmed the tribes' rights to harvest salmon and steelhead, and established tribes as co-managers of Washington fisheries.
Phase II of *United States v. Washington* (1980)	This ruling held that implicit in the tribal treaty rights to harvest fish is the right to have the habitat that supports the fishery protected. Although this ruling was subsequently vacated, other court cases have followed this doctrine. For example, in *Kittitas Reclamation District v. Sunnyside Valley Irrigation District* (1985), the court ruled that water should be released to protect salmon nests rather than diverted for irrigation (Morisset, 2001).

Tribal Treaty or Related Case Law	Effect
Treaty rights to Riverbeds, Lakebeds, and Tidelands Habitat	Tribes may have rights to tidelands, riverbeds, and lakebeds on reservation lands, if the original purposes of the reservation imply those rights. For example, in *Puyallup Indian Tribe v. Tacoma (*1983), the court ruled that the Puyallup Tribe still owned the old riverbed after an avulsive change in the river's course, because the riverbed was important to the tribe's fishing right (Morisset, 2001).
Treaty Rights in Shorelines	Tribal rights to regulate activities along shorelines in their reservations depend upon the specific legal history and situation of each reservation. However, the Shorelines Protection Act (RCW 90.58.350) states that nothing within the Act allows activities that may violate treaty rights, and the state may need to regulate shorelines that aren't adjacent to or on a reservation in accordance with treaty rights (Morisset, 2001).
Water Quantity	
On-Reservation Tribal Water Rights (*Winters v. United States*, 1908)	Tribal water rights are federal water rights and therefore are not subject to state law or procedures. Tribal water rights are granted along both navigable and non-navigable streams in reservations, date from the establishment of the reservation, and are considered appropriated to accomplish the purpose of the reservation (Morisset, 2001).
Off-Reservation Tribal Water Rights (*Washington v. Fishing Vessel Association, 1979*)	Tribes also have federal water rights in any usual and accustomed fishing places that are off the reservation. These water rights appropriate enough water to preserve the fishing right (Morisset, 2001), and derive from treaties. As a result, Indian water rights are the most senior water rights in any system (Osborn, 2001).
Instream Flows	
Instream Flows (*Postema, et al., v. DOE, et al., 2000*)	The Washington Supreme Court ruled that instream flows needed to support tribal fisheries must be protected (Morisset, 2000). These rights apply both on-reservation and off-reservation if needed to protect tribal fishing rights. These instream flow rights may be quite large, but usually they are not quantified (Osborn, 2001).

CURRENT EFFORTS

A wide range of government agencies, non-profit organizations, citizen groups, tribes, and other organizations are engaged in watershed planning in WRIA 17. These groups have implemented projects and programs that complement the recommendations in this plan. As part of the plan development process, all members of the WRIA 17 Planning Unit mailing list were sent a brief survey about their policies and programs. Seven organizations completed this survey:

- Jefferson County Conservation District
- Washington State University Extension – Jefferson County
- Washington Department of Ecology
- City of Port Townsend
- Jefferson County PUD #1
- Jefferson County
- Wild Olympic Salmon

The results of these seven surveys are summarized below.

Jefferson County Conservation District

In partnership with landowners, North Olympic Salmon Coalition, and Wild Olympic Salmon, the Jefferson County Conservation District has completed over 120 habitat-related projects since 1985. These projects fall into four major categories: riparian fencing, fish/stream habitat improvements, streambank stabilization, and riparian plantings. Highlights of the Conservation District's accomplishments include the following:

- The Jefferson County Conservation District fenced over 122,000 feet of 13 streams, including Leland Creek, Chimacum Creek, and the Big Quilcene River.
- It improved over 25,000 feet of fish and stream habitat on 15 streams, including Jakeway Creek, Putaansuu Creek, and Tarboo Creek; and it replaced six culverts (not including culverts on County roads) on Chimacum, Naylors, and Thorndyke Creek.
- The District also stabilized over 1600 feet of streambank along the Big Quilcene and Salmon Rivers, Puget Sound, and Tarboo Creek, and planted nearly 750 acres of riparian area along eight streams and rivers in WRIA 17.
- The District has conducted a water quality monitoring program since 1993. The purposes of the program are to evaluate the implementation of Best Management Practices (BMPs), track long-term trends, and identify stream reaches with water quality problems. Currently 16 stations in the Chimacum Creek watershed are monitored for dissolved oxygen, pH, temperature, conductivity, fecal coliform, total suspended solids, turbidity, nitrate-nitrogen, and total phosphorus. These parameters are also measured at upstream and downstream stations on Salmon, Snow, Tarboo, and Donovan Creeks. Additionally, 40 temperature data loggers are located on these and other streams to record hourly summer temperatures. Intragravel dissolved oxygen is measured monthly during the September-to-March egg incubation period in Chimacum and Salmon Creeks to assess spawning habitat for the ESA-listed summer chum.
- Since 1996, the Conservation District has assisted Wild Olympic Salmon by monitoring dissolved oxygen at its summer chum hatchery. Assessment of these data has led to improvements in the hatchery's aeration system.

- In 1997, the District assisted community members in developing an integrated aquatic plant management plan for Lake Leland. This effort included an intensive survey of invasive Brazilian elodea as well as native aquatic vegetation. Water quality in Lake Leland and its tributary system was also monitored.
- Since 1998, Chimacum School PIE students have assisted the District in monitoring water quality at 10 stations in the Chimacum Creek watershed. Data that the students collected have led to the identification of stream reaches with low dissolved oxygen levels. As a result of this effort, stream restoration work on more than one-half mile of East Chimacum Creek began in 2003.
- With the assistance of numerous landowners and other volunteers, the District has conducted a fish trapping program to assess juvenile salmonid abundance in several streams in Jefferson County.

Washington State University Extension – Jefferson County

The Washington State University Extension – Jefferson County focuses on public education about salmon, their habitat, water quality, watersheds, and other natural resource topics. The organization offers a wide range of classes and educational opportunities to kids, the general public, and specific professionals, such as realtors. A sample of WSU's offerings includes the following:

- Water Watchers classes, taught each year, cover water, local watersheds, and human impacts to these resources. In return for the classes and field trips, students are expected to volunteer 50 hours to local projects of their choice.
- Realtor Trainings present information on salmon, streams, the nearshore environment, septic systems, and other natural resource topics to realtors on the Olympic Peninsula. Participants receive clock hours.
- In partnership with realtors, WSU Extension – Jefferson County developed a new program in 2003 called "Welcome to the Watershed – Watershed Neighbors." Monthly evening programs familiarized new residents with watershed issues, and field trips on Saturdays explored the Chimacum Watershed from source to estuary. Participants also received information about which county staff to call about different natural resource topics.
- Kids ages 7 to 14 attending the Jefferson County Summer Activities Day Camp can take Salmon Explorers, a six-week class about local watersheds, the lifecycle of the salmon, and the types of habitats salmon need to survive.
- Similarly, WSU Extension – Jefferson County provided campers ages 6 to 12 at the WSU 4-H Summer Camp with presentations about how everyday activities affect surface and groundwater and how kids can protect water quality. The WSU 4-H program also provides a Natural Resources Camp that educates school-age children.
- On August 7, 2003, teens aged 15 to 18 helped restore a section of Chimacum Creek as part of PACIFIC NORTHWEST TRAILS. They also learned about the relationship between surface water and salmon habitat, the history of the watershed, and the links between the condition of the creek and water quality.
- WSU also manages a Master Gardeners Program. Among other topics, the course covers water quality, alternatives to pesticide use, native plants, and water conservation.

Washington Department of Ecology

The Governor's Office designated the Washington Department of Ecology as the agency to represent the state's interests in WRIA 17. At the request of the Initiating Governments, Ecology has participated in WRIA 17 planning as a member of the Planning Unit, the Technical Committee, and the Steering Committee. Ecology also has provided a wealth of technical and planning support to the Planning Unit, as has the Department of Fish and Wildlife. In addition, Ecology administers the grants that make watershed planning possible in WRIA 17, and provides "supplemental" watershed planning funds so that the WRIA can address instream flows, water storage, and water quality issues.

Ecology contributes to water resource management in WRIA 17 in other ways. For example, Ecology provides Water Quality and Coastal Zone Management Grants to local governments, and the agency funds stream gauging efforts in WRIA 17. Ecology also has provided technical assistance on addressing seawater intrusion problems.

City of Port Townsend

The City of Port Townsend has implemented a number of programs designed to monitor water resources in WRIA 17, such as the following:

- The City monitors drinking water quality and stream temperature at its diversions on the Big and Little Quilcene Rivers. Since 1992, the City has taken daily grab samples to measure turbidity, and the City has recorded temperature readings hourly between June and October since 2002.
- Additionally, the City tests its drinking water at the two diversions and at City Lake for inorganic, volatile organic compounds, and synthetic organic compounds. The City has tested its water for these substances since 1981.
- Downstream of the municipal diversions on the Big and Little Quilcene Rivers, the City monitors stream flows continuously. This program has been in place on the Big Quilcene since 1993 and on the Little Quilcene since 1994. The City partners with the US Geological Survey to conduct this monitoring.
- The City also partners with the National Resources Conservation Service to monitor snowpack, precipitation, and temperature at 4,050 feet of elevation on Mount Crag. This site is located between the Big Quilcene and the Dosewallips watersheds. The two organizations have collected these data since 1991.
- Currently, the City is assessing the effect of municipal diversions and pipelines as part of its effort to renew its Special Use Permits with the US Forest Service for that infrastructure.
- Since 1942, the City has worked with the National Weather Service to operate a rainfall gauge at the Big Quilcene River municipal diversion.

Jefferson County PUD #1

The primary public utility in WRIA 17, the Public Utility District #1, also has been working to protect and monitor water resources in the watershed. A sample of the PUD's programs follows:

- Jefferson County PUD #1 offers homeowners a program in which they can elect to have the PUD monitor their wells for seawater intrusion. The PUD tests the wells bi-annually for chloride and specific conductance. This program, which began in 2002, focuses on Marrowstone Island and also includes other likely locations around the county from Gardiner to Brinnon. The effort will continue at least through the fall of 2005.

- The PUD supports efforts to make rain barrels available to homeowners interested in using them for water conservation and outdoor purposes. The PUD donated funds to Water Watchers to support the purchase of rain barrels for subsequent sale to residents. This ongoing program reaches out to homeowners in east Jefferson County.
- The PUD is currently updating its water system plan, which includes a water conservation plan. This plan has many objectives: to increase efficiency of water use, improve leak detection and repair, decrease water demand, improve metering of water that currently is not accounted for, and set and meet targeted conservation goals. The plan will cover the entire district, and it is scheduled for adoption in 2004.

Jefferson County

Since much of WRIA 17 is unincorporated, Jefferson County government policies and programs have significant effect upon the watershed's resources. Recently, Jefferson County reviewed its regulations to determine how they protect water resources, including ESA-listed salmon species and their habitat. Key findings from this review include the following:

- The Jefferson County Comprehensive Plan sets zoning in the county, and provides policy guidance for achieving goals associated with land use regulations. This document directs Jefferson County to protect ESA-listed species and their habitat, manage water resources using the best available scientific information, protect and restore surface and groundwater quantity and quality, and work with other agencies to improve understanding of water resources in the county.
- Jefferson County updated environmental protection standards when it adopted the Unified Development Code in December 2000. To develop these standards, the County reviewed best available science and increased protection standards for wetlands and other fish and wildlife habitat, increased requirements for bank protection, and included provisions to restrict development in the entire river channel migration zone.
- Jefferson County has adopted a number of measures to reduce the risk of seawater intrusion to coastal aquifers. Jefferson County is one of only three counties in Washington that restricts development on properties using an individual well (i.e., exempt from a water right permit). In areas at risk for seawater intrusion, the County requires infiltration of all runoff and ongoing monitoring of water use and water quality. In areas of higher risk, the standards are much more stringent: Jefferson County does not allow outdoor plumbing; it requires that specialized well pumps be used; and it also requires a complete hydrogeologic assessment to demonstrate no detrimental well interference. Additionally, the County has adopted a subdivision moratorium on Marrowstone Island, due to seawater intrusion concerns.
- The Flood Damage Prevention Ordinance, while not focused on habitat protection, has provisions that limit the alteration of natural floodplains and stream channels.
- Although the state regulates most forest practices, Jefferson County conducts SEPA analyses on Class IV forest conversions. The County's Interim Timber Conversion Policy provides policy guidance on these conversions, requiring project proponents to submit conversion option harvest plans to address environmental and land use issues.
- In 2002, Jefferson County adopted the Department of Ecology's 2001 Stormwater Management Manual for Western Washington, and to date it remains the only county in the state to do so. The requirements increase detention of stormwater, improve treatment standards, and encourage development practices that maintain the natural hydrology.

- The County's Agricultural Lands Ordinance designates and provides for conservation of agricultural lands. The UDC was amended in 2003 and contains environmental protection standards for agricultural activities, including those activities that existed prior to adoption of the ordinance.
- The County also has undertaken several floodplain management projects. It has developed a Comprehensive Floodplain Management Plan. As part of plan implementation, the County acquired 53 acres of floodplain in the Big Quilcene River, and 22 acres in the Little Quilcene River. It also has removed and set back dikes on both rivers. The County is currently studying potential redesigns for the Linger-Longer Bridge, which would allow improved floodplain function.
- The Jefferson County Public Works Department has taken a number of steps to protect water resources in WRIA 17. The department recycles its motor oil and antifreeze, operates a Moderate Risk Waste facility and collection programs, is working to implement the Tri-County Roads Maintenance Program, and conducts street sweeping and stormwater catch basin maintenance.

Wild Olympic Salmon

Wild Olympic Salmon (WOS), a nongovernmental organization, conducts a variety of educational efforts and restoration projects in the watershed, including the following activities:

- Wild Olympic Salmon provides education materials on the water cycle to classrooms through the Tracking the Dragon books.
- WOS provides a forum for watershed education at the biannual Salmon Festival as well as various community meetings.
- WOS sponsors the volunteer Summer Chum Broodstock program on Chimacum, Salmon, and Jimmycomelately Creeks.
- Wild Olympic Salmon's traveling salmon sculpture "Fin" provides outreach and recognition for water quality and resource conservation throughout the region.
- WOS volunteers have performed habitat monitoring in the Chicacum and Salmon/Snow watersheds.
- Wild Olympic Salmon's partner organization, North Olympic Salmon Coalition (NOSC), provides extensive outreach and education through volunteer restoration, monitoring, and broodstock programs.
- NOSC provides technical assistance to Washington State University Extension's Realtor Trainings, 4-H Natural Resources Camp, PACIFIC NORTHWEST TRAILS, Jefferson County Summer Camp education programs, and other efforts.

IMPLEMENTATION OF WATERSHED PLAN RECOMMENDATIONS

This Watershed Management Plan is the result of four years of hard work, collaboration, and discussion among the many members of the WRIA 17 Planning Unit. The centerpiece of the Plan is the list of 43 recommended actions to protect and enhance water quantity, water quality, instream flows, and habitat in the watershed. Table 10 provides an overview of these recommendations in summarized form; please refer to the body of the Plan for full text and explanations of the recommendations. Check marks denote which entities the Planning Unit believes should implement each recommendation.

The table provides some general guidance on implementation of the WRIA 17 Watershed Management Plan. However, it does not provide information about timelines, funding, data management, measures for success, and long-term oversight. Therefore, the WRIA 17 Planning Unit should consider developing and adopting a detailed Implementation Plan to accompany this Watershed Management Plan.

Table 10: Summary of Watershed Plan Recommendations and Implementation Responsibilities

RECOMMENDATION	All Planning Unit Members	Jefferson County	City of Port Townsend and Future Cities	PUD #1	Department of Ecology	Other Planning Unit Members
Water Quantity Recommendations						
1. Prepare and implement water conservation plans			✓	✓		
2. Increase public awareness and education on water use	✓	ALL PLANNING UNIT MEMBERS				
3. Coordinate regional drought contingency and system security planning			✓	✓		
4. Participate in water rights acquisition programs	✓	ALL PLANNING UNIT MEMBERS				
5. Protect critical aquifer recharge areas and wellhead protection zones	✓	ALL PLANNING UNIT MEMBERS				
6. Better implement water-metering and reporting requirements in the WRIA	✓	ALL PLANNING UNIT MEMBERS				

RECOMMENDATION	All Planning Unit Members	Jefferson County	City of Port Townsend and Future Cities	PUD #1	Department of Ecology	Other Planning Unit Members
7. Facilitate compliance with existing laws and regulations regarding illegal water withdrawals	✓	ALL PLANNING UNIT MEMBERS				
8. Identify where existing laws constrain wise water use and promote changes to these laws	✓	ALL PLANNING UNIT MEMBERS				
Water Quality Recommendations						
9. Continue Conservation District program with landowners						✓
10. Protect and restore riparian vegetation		✓				✓
11. Reduce pesticide and herbicide use	✓	ALL PLANNING UNIT MEMBERS				
12. Reduce use and release of synthetic organic compounds	✓	ALL PLANNING UNIT MEMBERS				
13. Implement a surface and ground water quality monitoring plan	✓	ALL PLANNING UNIT MEMBERS				
14. Encourage water quality monitoring	✓	ALL PLANNING UNIT MEMBERS				
15. Work with state agencies to upgrade water quality data accessibility	✓	ALL PLANNING UNIT MEMBERS				
16. Adopt surface water and/or stormwater management plans		✓	✓			
17. Adopt stormwater management manual		✓	✓			
18. Provide public education for water quality	✓	ALL PLANNING UNIT MEMBERS				

RECOMMENDATION	All Planning Unit Members	Jefferson County	City of Port Townsend and Future Cities	PUD #1	Department of Ecology	Other Planning Unit Members
19. Compile and track public outreach and education programs	✓	ALL PLANNING UNIT MEMBERS				
Habitat Recommendations						
20. Support the Hood Canal Coordinating Council's salmon habitat restoration efforts	✓	ALL PLANNING UNIT MEMBERS				
21. Utilize the Limiting Factors Analysis and Refugia Study to guide habitat restoration activities	✓	ALL PLANNING UNIT MEMBERS				
22. Support local salmon recovery efforts	✓	ALL PLANNING UNIT MEMBERS				
23. Advocate for changes to the Conservation Reserve Enhancement Program	✓	ALL PLANNING UNIT MEMBERS				
24. Conserve instream wood, formalize large wood stockpiling efforts, and collaborate on education	✓	ALL PLANNING UNIT MEMBERS				
25. Update and revise maps of sensitive areas	✓	ALL PLANNING UNIT MEMBERS				
26. Adopt and implement a stormwater management manual		✓	✓			
27. Adopt countywide road maintenance standards		✓	✓			
28. Continue to enforce Jefferson County development regulations		✓				

RECOMMENDATION	All Planning Unit Members	Jefferson County	City of Port Townsend and Future Cities	PUD #1	Department of Ecology	Other Planning Unit Members
29. Transfer regulatory authority over Class IV general forest practices to local governments		✓	✓			
30. Secure a permanent, stable revenue source to maintain adequate fish passage	✓	ALL PLANNING UNIT MEMBERS				
31. Expand citizen-based salmon habitat programs	✓	ALL PLANNING UNIT MEMBERS				
32. Support the Washington Water Acquisition Program	✓	ALL PLANNING UNIT MEMBERS				
33. Investigate a transfer of development rights program		✓	✓		✓	
34. Provide public education about the value of healthy habitats and the importance of habitat restoration efforts	✓	ALL PLANNING UNIT MEMBERS				
35. Compile and track public outreach and education programs	✓	ALL PLANNING UNIT MEMBERS				
Instream Flow Recommendations						
36. Adopt instream flows	✓	ALL PLANNING UNIT MEMBERS				
Overarching Recommendations						
37. Pursue other funding and revenue options	✓	ALL PLANNING UNIT MEMBERS				
38. Coordinate planning across numerous agencies	✓	ALL PLANNING UNIT MEMBERS				

RECOMMENDATION	All Planning Unit Members	Jefferson County	City of Port Townsend and Future Cities	PUD #1	Department of Ecology	Other Planning Unit Members
39. Improve the sharing of existing information and data gathering	✓	ALL PLANNING UNIT MEMBERS				
40. Update critical areas ordinance and shoreline master programs		✓	✓			
41. Adjust boundary line between WRIA 17 and WRIA 18	✓	ALL PLANNING UNIT MEMBERS				
42. Improve communication with the public	✓	ALL PLANNING UNIT MEMBERS				
43. Amend or update Watershed Plan	✓	ALL PLANNING UNIT MEMBERS				

Appendix 2: Climate Variability, Climate Change, and Watershed Planning

Climate Variability, Climate Change, and Watershed Planning

The following information is from the Climate Impacts Group (CIG) at the University of Washington in Seattle. Lara Whitely Binder is the lead author, and she can be contacted for additional information at (206) 616-5349 or whitelybinder@yahoo.com.

The availability of water resources in Pacific Northwest (PNW) watersheds can be affected by short term variations and long term changes in climate. Understanding how natural climate variability and global climate change affect PNW climate and water resources can help watershed planning units more effectively manage water supplies for current and future water supply needs.

Extensive research conducted by the Climate Impacts Group (CIG) at the University of Washington has furthered our region's understanding of the impacts of climate variability and change on the PNW. While the effects cross-cut many natural systems, including coastal and forest environments, the most significant impacts are those on water resources.

The following provides a brief overview of known and projected impacts of climate variability and climate change on water resources, and their relevance to watershed planning. For more detail, please contact the Climate Impacts Group at the University of Washington (www. http://www.cses.washington.edu/).

1 PNW Climate Variability

Variations in PNW climate are largely driven by two large-scale patterns of climate variability: the El Niño/Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO).

1.1 El Niño/Southern Oscillation

The El Niño/Southern Oscillation (ENSO) is the major source of *inter-annual* (year-to-year) climate variability in the PNW. ENSO cycles are more commonly known as El Niño (the warm phase of ENSO) or La Niña (the cool phase of ENSO). An El Niño is characterized by stronger than average sea surface temperatures and weaker easterly trade winds in the equatorial Pacific Ocean. A La Niña is characterized by the opposite – cooler than average sea surface temperatures and stronger than normal easterly trade winds. ENSO events tend to form between April and June, typically reaching full strength in December. ENSO phase typically lasts 6 to 18 months (Figure 1).

Although ENSO is centered in the tropics, the changes associated with El Niño and La Niña events affect climate around the world. The ENSO influence on PNW climate is strongest from October to March. Recent El Niño years include 1992, 1995, 1998, and 2003[1]. Recent La Niña years include 1996, 1999, 2000, and 2001. Average years, i.e., years where there is no statistically significant deviation from average conditions at the equator, are called ENSO-neutral. Recent ENSO-neutral years include 1991, 1993, 1994, 1997, and 2002.

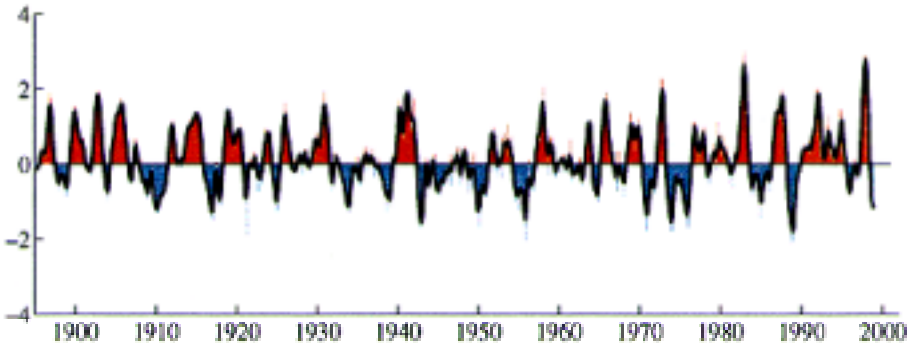

Figure 1: Monthly values for the NINO3.4 Index, 1900-1998. Positive (red) values indicate an El Niño. Negative (blue) values indicate a La Niña.

1.2 THE PACIFIC DECADAL OSCILLATION

The Pacific Decadal Oscillation (PDO) is the predominant source of *inter-decadal* (decade-to-decade) climate variability in the PNW. The PDO produces long-term (typically 20 to 30 year[2]) shifts in North Pacific sea surface temperatures with secondary effects on coastal sea surface temperatures in the PNW. A warm phase PDO brings warmer sea surface temperatures to the PNW coast while a cool phase PDO brings cooler sea surface temperatures. These changes have been linked to boom/bust cycles in certain marine and anadromous fish populations, including salmon, as well as variations in temperature and precipitation in the PNW.

Studies indicate that the PDO was in a cool phase from approximately 1890 to 1925 and 1945 to 1977 (Figure 2). Warm phase PDO regimes existed from 1925-1946 and from 1977 to (at least) 1998. The PDO switched to a cool phase in July 1998 but moved back into a warm phase in August 2002. It is too early at this point to tell if the warm phase will continue or if it will return to a cool phase.

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[1] The years listed refer to the fall (October-December) of the preceding calendar year and winter (January-March) of the listed year. For example, 1992 is fall 1991/winter 1992.

[2] This conclusion is based on 20th century observations and has been confirmed to a significant degree by historic analysis of PNW tree rings and geoduck shells (Gedalof 2001; Strom 2003).

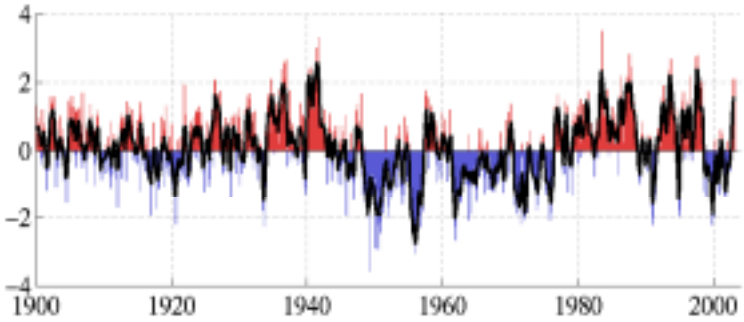

Figure 2: Monthly values for the PDO index, Jan. 1900-Feb. 2003. Positive (red) values indicate a warm phase PDO. Negative (blue) values indicate a cool phase PDO.

While the scientific community is reasonably agreed on the factors contributing to ENSO events, the causes – and therefore the predictability – of the PDO are not well known. Part of the difficulty in understanding what triggers PDO phase shifts is the length of PDO events relative to the length of instrumental records for the north Pacific. Because of the persistence of the PDO phases, we have seen relatively few shifts between cool and warm phases of the PDO since 1900, the earliest availability for sea-surface temperature records (Mote et al. 2003).

1.3 Impact of Climate Variability on PNW Climate and Water Resources

Analysis of past ENSO and PDO events show that warm phases of ENSO (El Niño) and PDO increase the potential for below normal winter (October-March) precipitation and above normal winter temperatures in the PNW. An exception to this dry-warm pattern occurs during strong El Niños. While moderate El Niños can lead to warmer and drier winters, strong El Niños (such as the winter of 1997-1998) tend to be warmer and wetter (Mantua and Mote 2003). Cool phases of ENSO (La Niña) and PDO increase the potential for above normal winter precipitation and cooler winter temperatures in the PNW. When the two events are in-phase (El Niño and warm phase PDO or La Niña and cool phase PDO), the potential for temperature and precipitation extremes (i.e., floods and droughts) increases.

The changes in temperature and precipitation associated with ENSO and PDO have widespread impacts on PNW resources. El Niño and warm phase PDOs increase the probability for *reduced* snowpack, streamflow, flooding, salmon returns (PDO only), and coastal and near-shore habitat quality, while *increasing* the probability for drought and forest fires. La Niña and cool phases of the PDO increase the probability for the opposite effects (Table 1; Figures 3-5).

Climate State	Changes in Avg. Streamflow
El Niño	- 12%
La Niña	+ 8%
Warm phase PDO	- 9%
Cool Phase PDO	+ 6%
El Niño/warm phase PDO	- 17%
La Niña/cool phase PDO	+14%

Table 1: Changes in Average Annual Streamflow for the Columbia River for ENSO and PDO phases. Changes are expressed as a percentage change from the mean annual flow for 1900-1998 after the effects of dams have been removed. Changes in flow are most pronounced during the spring and summer (April –September). Average flow anomalies are higher on average when ENSO and PDO are in the same phase (Mote et al. 2003).

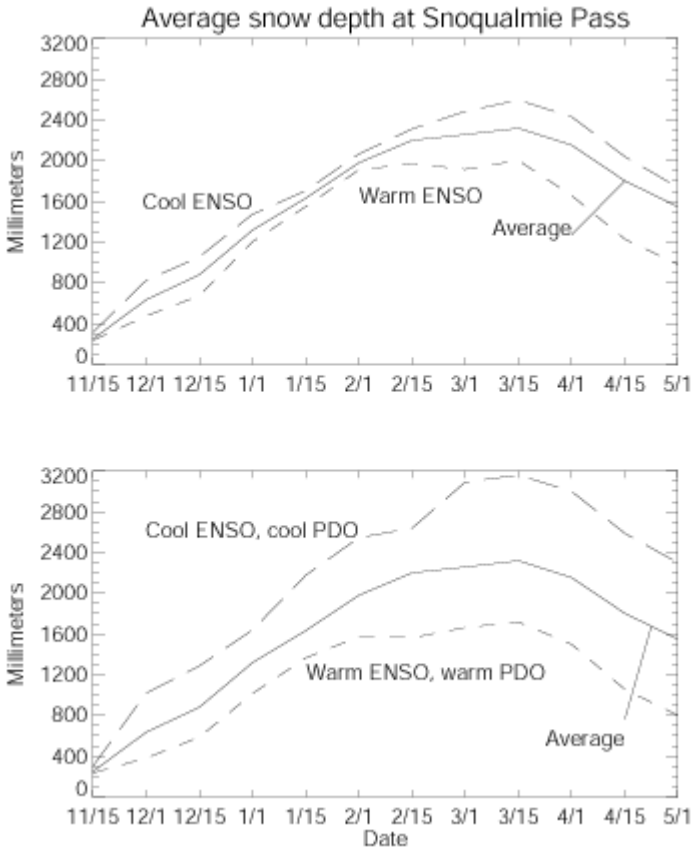

Figure 3: Average cumulative snow depth at Snoqualmie Pass, Washington for 1929-1997, for the warm and cool phases of ENSO (top) and ENSO/PDO in phase (bottom). Data were collected by cooperative observers, and were extracted from records of the National Climatic Data Center.

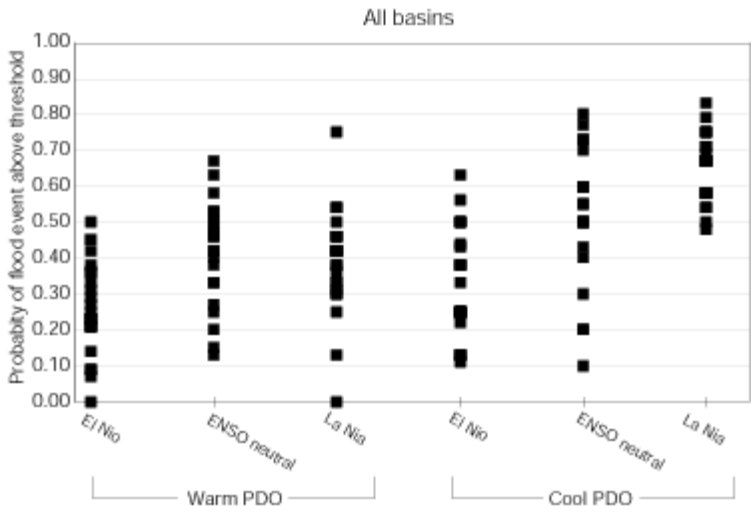

Figure 4: Influence of Climate Variability on PNW Flooding. Figure 4 illustrates how the probability of flooding in the PNW varies with ENSO and PDO phases. The results are based on analysis of long (57-65 years) streamflow records from 26 unregulated basins throughout the PNW. The probability of flooding was defined as the probability that the observed daily streamflow exceeded the mean annual flood at least once during the year. There is a clear overall trend from low to high probability of flooding across the climate categories from warm PDO/warm ENSO (El Niño) to cool PDO/cool ENSO (La Niña) conditions.

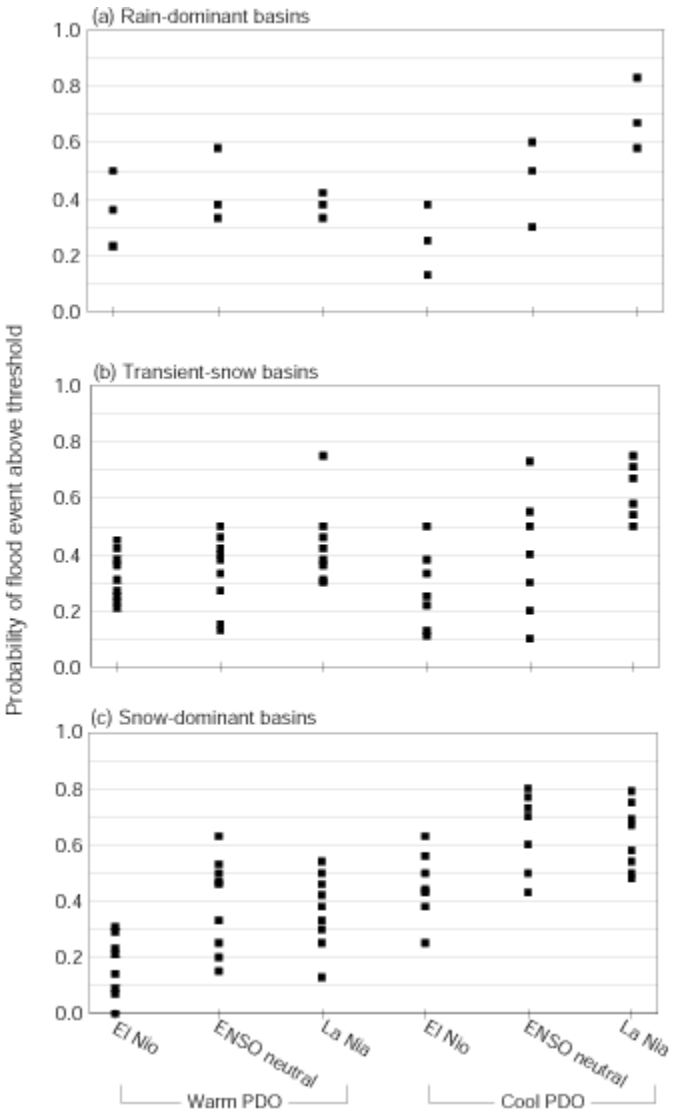

Figure 5: Influence of Climate Variability on PNW Flooding by Basin Type. Figure 5 breaks out the results from the flood analysis referred to in Figure 4 by basin type. Snow-dominant basins show the greatest sensitivity to PDO and ENSO conditions. Whereas flooding in rain dominated basins results from individual storms, flooding in snowmelt basins depends on the weather over the entire winter and spring (i.e., the period of mountain snow accumulation) as well as on individual storms. Wintertime climate is more sensitive to PDO and ENSO states than single intense precipitation events.

2 Climate Change

Global climate change is expected to play a significant role in re-shaping PNW climate and hydrology. While climate variability is strongly influenced by natural ENSO and PDO cycles, global climate change is driven by increases in atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases[3] from both human and natural sources. These gases effectively trap energy reflected from the earth's surface and re-radiate the energy back towards the earth, resulting in an overall increase in global temperature over time.

Since the beginning of the 20th century, average annual global temperature has increased by about 1.1° F (0.6 ° C). In the PNW, the average annual temperature increased +1.5°F (0.8° C) during the 20th century (Mote et al. 2003). The PNW has also gotten wetter over the 20th century, with an increase in average annual precipitation for the PNW of 14% (ibid).

Most climate models project warmer, wetter winters and warmer, drier summers for the PNW as a result of climate change. Global climate models project an increase in average annual temperature of 4.1°F (2.3°C) and precipitation (+7%) for the PNW by the decade of the 2040s (Table 2). It is important to note that temperature changes related to climate change are projected to continue through the 21st century even with stabilization of CO_2 emissions (IPCC 2001). Consequently, while temperature projections are available through the 2040s, these projections do not necessarily represent an end-point for assessing system response.

2020s	Temperature	Precipitation
Low	+ 0.8 °F	+ 1.5%
Mean	***+ 2.7 °F***	***+ 6.9%***
High	+ 4.6 °F	+ 14.4%

2040s	Temperature	Precipitation
Low	+ 2.7 °F	- 3.3%
Mean	***+ 4.1 °F***	***+ 7%***
High	+ 5.7 °F	+ 13.7%

Table 2: Projected Changes in Average Annual PNW Temperature and Precipitation for the decades of the 2020s and 2040s. The projections are based on analysis of eight climate models driven by an increase in equivalent carbon dioxide of approximately 1% per year. Changes are benchmarked to the decade of the 1990s.

[3] The most common greenhouse gases are water vapor, carbon dioxide, methane, and nitrous oxide. Other greenhouse gases include, but are not limited to, various fluorocarbons (hydro-, per-, chloro-) and halons.

2.1 CLIMATE CHANGE IMPACTS ON PNW WATER RESOURCES

Despite the projected increase in average annual precipitation, the availability of water – especially during drier summer months - may actually *decrease* with climate change (Mote et al. 1999). Warmer winter temperatures reduce both the quantity and elevational extent of snowpack as more winter precipitation falls in the form of rain rather than snow. The shift in precipitation type, combined with the warmer temperatures and loss of snowpack, contributes to higher winter (October-March) streamflow, reduced spring/summer streamflow (April-September), and a shift in peak spring runoff earlier into the spring by two to six weeks (Figure 6). Timing shifts of this magnitude can affect the availability of water for all users but could be particularly detrimental to migrating juvenile salmon, which depend on cool and ample flows in the late spring for migration. Increased winter flooding is also expected as more winter precipitation falls as rain.

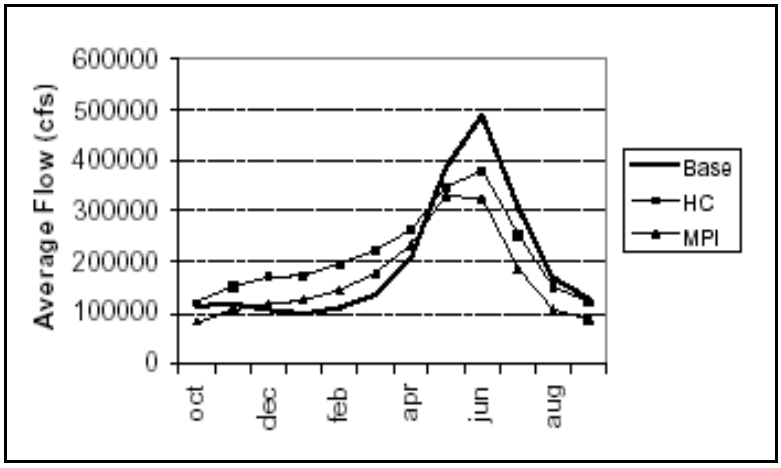

Figure 6: Changes in Average Monthly Flows by 2045 for the Columbia River at the Dalles as a Result of Climate Change as Simulated by Two Transient Global Climate Models. The base case represents the composite simulated historical hydrograph for 1961 to 1997. The hydrograph for 2045 flows represents the effects to streamflow of perturbing the historical record of temperature and precipitation by the climate changes simulated by the Max Planck Institute (MPI) and Hadley Center (HC) climate models (see Miles et al. 2003).

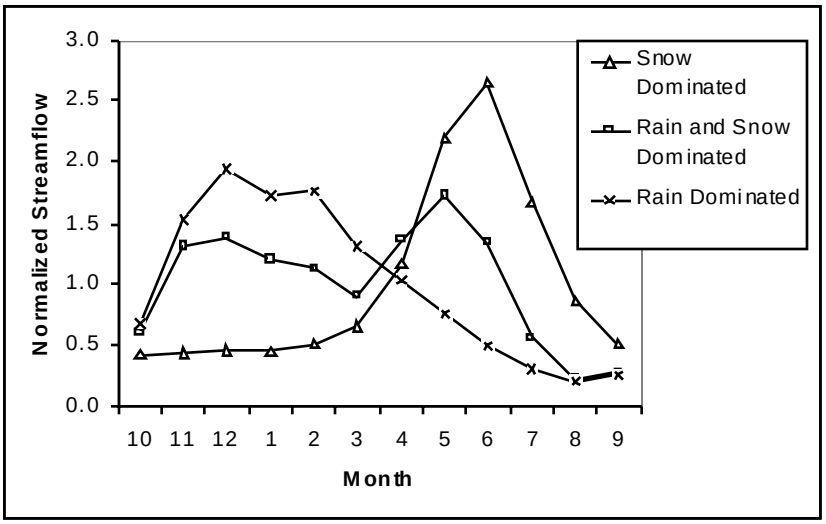

Figure 7 - Seasonal distribution of streamflow for snowmelt dominant, transient (rain/snow dominant), and rain dominant river basins in the PNW. High elevation snow dominant basins have a single peak hydrograph in the spring (months 4-7) as accumulated winter snowpack melts. Mid-elevation rain/snow dominant basins have a double peak hydrograph with the first peak occurring during the fall rains (months 10-12) and the second peak occurring in the spring with melting of the higher elevation winter snowpack. Low elevation rain dominant basins have a single peak hydrograph in the fall and winter (months 10-3) with the winter rains (Hamlet 2001a).

The degree to which climate change affects water resources depends on the elevation of the basin and dominant type of precipitation contributing to flows in the watershed (Figure 7). Higher elevation (typically > 6,000 feet) snowmelt-dominated basins are significantly affected by decreases in snow pack and earlier peak flows. Under normal conditions, winter precipitation falls primarily as snow in the higher elevations with runoff of accumulated snows in late spring and early summer (May/June). These late flows are critical to meeting water demands through the drier summer months. The reduced snow pack and earlier peak flows associated with climate change may limit a watershed's ability to meet summertime water demands.

Transient or rain/snow dominant basins (typically 3,000-6,000 feet) are most susceptible to changes in precipitation and the timing of peak flows. Transient basins have two seasonal runoff peaks under normal conditions. The first peak occurs in mid-winter with the peak in winter rainfall (November-January). The second seasonal runoff peak occurs with the late spring/early summer snowmelt (May/June). Transient basins are considered most vulnerable hydrologically to climate change given that average winter temperatures in these basins rest on or near the freezing threshold. A few degrees of warming is enough to shift temperatures above freezing for longer periods of time, shifting more winter precipitation from snow to rain. As with snowmelt-dominated basins, runoff from winter snowpack is critical to meeting summertime water demands. Therefore,

changes in the type and timing of seasonal flows may affect a transient basin's ability to meet water demands during the driest time of the year.

The third basin type is lower elevation (typically less than 3,000 feet) rain-dominated basins. Temperatures in rain-dominated basins tend to stay above freezing so most precipitation falls as rain. Peak flows in rain-dominated basins occur in winter with the onset of the rainy season. Increases in winter rainfall as a result of climate change increase the likelihood for flooding in these basins. This, in turn, contributes to an increased risk for erosion, damage to flood control structures and floodplain development, and loss of salmon eggs ("redds") to high flow riverbed scouring events. The ability to meet summer water demands may also be affected. These risks are greatest for unmanaged rivers west of the Cascades mountain range.

2.2 FUTURE CLIMATE VARIABILITY

There is no clear consensus at this time regarding the impact of climate change on the frequency and/or severity of ENSO and PDO events. Three potential scenarios are described in Mote et al. 1999. The first, and simplest, scenario is a moderation of ENSO and PDO events such that PDO and ENSO cease to vary between extremes. Climate change scenarios modeled under this assumption would project a smooth progression in temperature and precipitation through the 21st century in response to climate change without the "noise" of ENSO and PDO events.

The second scenario is a continuation of 20th century ENSO and PDO variability. Observed 20th century ENSO and PDO impacts on temperature and precipitation would be expected to continue with the added impact of climate change. Years when ENSO and PDO are both in cool phase, therefore, would have higher winter streamflows than any yet observed, while years when ENSO and PDO are both in warm phase would have lower snowpack and spring and summer streamflow than any yet observed.

The third, and potentially more likely scenario, is a change in the behavior of ENSO and PDO. More frequent El Niños and/or more frequent reversals of PDO phases could occur, contributing to more variability even as global average temperatures increase with climate change.

3 Impacts of Climate Variability and Change on Water Quality

Changes in water quality can have a significant impact on the ability of water bodies to support aquatic life and to serve as a drinking water source for growing populations. While most water quality degradation is attributed to human influences, climate variability and change may exacerbate existing, or contribute to new, water quality problems within a watershed when these changes exceed the buffering capacity of the system (Murdoch et al. 2000).

The following is a brief overview of key surface and groundwater quality parameters which can affect water use and function within Washington State. Anticipated effects of climate variability and change on water quality parameters are provided. *It is important to note that the following overview is based strictly on literature review.* The CIG has not to date undertaken any comprehensive studies on water quality impacts associated with climate variability and change.

It is also important to note that changes in water quality will vary across and within streams in a watershed. Therefore, while water quality may be degraded in one part of the watershed (or, for example, within the lower reach of a stream), the same degradation may not be found elsewhere in the watershed (or stream). C*onsistent baseline monitoring for trends in flow, temperature, and water chemistry is key to determining climate influences on water quality* (ibid).

3.1 FLOW

Changes in streamflow have an important influence on ecological and chemical processes within a watershed. Reductions in streamflow may:

- decrease surface water quality by increasing the concentration of chemical constituents, particularly downstream of point source discharges;
- lead to an increase in water temperature and subsequent decrease in dissolved oxygen levels;
- contribute to increased salt water intrusion into the tidal reaches of rivers in coastal areas;
- increase productivity and chemical reaction rates. The extent to which this helps or hinders water quality will depend on the specific chemical parameters; and
- require adjustments to point source discharge permits and non-point source pollution control programs as a result of these and other potential impacts to surface water quality (Meyer et al. 1999, Murdoch et al. 2000).

Lower flows also limit migration and access to spawning and rearing habitat for salmonids and other critical riparian species, and may affect competition and predation levels among aquatic species (Meyer et al. 1999).

Increases in streamflow and fluctuations in flow may also affect water quality. Increases in streamflow increase pollutant and sedimentation loads from non-point source runoff (Murdoch et al. 2000). Pulses of runoff associated with storms can

contribute to short-term changes in water quality that are toxic to fish. These short-term changes may occur even where water quality is met during median flows and can be very difficult to detect under traditional base flow sampling (ibid). Flow increases may also lead to increased scouring of salmonids eggs ("redds") along stream bottoms.

Climate variability and change can affect stream flow volumes in the PNW. El Niño and warm phase PDO events increase the probability for lower precipitation and streamflows; La Niñas and cool phase PDO events increase the probability for higher precipitation and streamflows. Climate change is projected to lower overall summer flows while increasing winter precipitation and streamflow.

The extent to which flow changes will affect ecosystem function and water quality depends in part on size of the change relative to the natural flow regime of the system. As noted in Meyer et al. (1999), highly variable systems (e.g., a rain-dominant system) may be severely disturbed by changes that make a system more predictable. Conversely, systems which are naturally stable (e.g., a snowmelt-drive system) may be significantly impacted by more variable flows.

3.2 WATER TEMPERATURE

Water temperature is an important determinant for rates of physical, biologic, and chemical processes in water bodies, including density, specific weight, viscosity, surface tension, thermal capacity, enthalpy (heat content), vapor pressure, specific conductivity and conductance, salinity, and solubility of dissolved gases (GeoEngineers 2001). Temperature is also a major factor in the ability of stream habitats to support salmonid species. High water temperatures can affect the timing of salmonid migration and maturation and leave salmonids more susceptible to disease outbreaks, potentially reducing survival rates in freshwater habitats (James and Sheeler 2001). In general, temperatures in the range of 69-72°F (21-22°C) act as a thermal barrier to salmonid migration; temperatures above 75°F (24°C) are lethal to juvenile salmon (Mantua and Francis, 2003).

Increased water temperatures may result from urbanization, reduced flows, increased sedimentation, point source industrial discharges, stormwater runoff, diking, irrigation return flows, loss of riparian vegetation, and water withdrawals. Washington State water quality regulations restrict water temperature in Class A (excellent) waters to 64.4°F (18°C) due to human activities.

Climate variability and change may increase water temperatures through lower summer streamflows and warmer ground surface temperatures. These increases may induce secondary changes in water quality as physical, chemical, and biological processes change in response to the warmer temperatures. Habitat conditions may also be affected. According to recent USGS studies on water temperatures and fish tolerances, a 3.6-10.8°F (2-6°C) temperature increase could reduce stream habitat nationally for cold and cool water fish by as much as 50% (Murdoch et al. 2000 p362).

3.3 DISSOLVED OXYGEN (DO)

Dissolved oxygen refers to the amount of free (not chemically combined) oxygen in water. DO is an important determinant for a water body's ability to support fish or other aquatic organisms[4]. DO is also necessary for the prevention of offensive odors. In Washington State, DO requirements will vary with the classification of the water system. In Class A (excellent) waters, for example, DO levels cannot fall below 8.0 mg/L (Golder Associates 2001).

DO levels are affected by various factors, including water temperature, inflow quality, and water turbulence. Increases in water temperature decrease the amount of oxygen water can hold, leaving less water available for aquatic life. Point and non-point source inflows with high organic or low DO levels can reduce DO in the receiving water body (Golder Associates 2001 p.6-9). Examples include waste discharges, agricultural discharges, urban stormwater, sediment, and algae[5]. Conversely, DO levels may increase with water turbulence, which exposes more of the water's surface area to air.

Low flows resulting from ENSO/PDO events and climate change may contribute to increased water temperatures and, as a result, reduced DO levels in Washington water bodies. Because DO is a regulated water quality parameter, further degradation of DO levels may trigger additional water quality restrictions.

3.4 PH

pH measures how acidic or alkaline a water body is using a scale of 0 (acidic) to 14 (alkaline). Neutral water has a pH of 7. Water is more acidic as the pH value decreases from 7 and more alkaline as the pH value increases from 7.

pH is an important determinant of water chemistry and resulting water quality. Some water quality parameters become more soluble (i.e., able to dissolve in water) as pH moves from neutral to more acidic or alkaline. Phosphorus, for example, becomes more available for plant growth when dissolved in water. Increases in dissolved phosphorus can lead to algal blooms and excessive plant growth, lowering the amount of dissolved oxygen available for aquatic life. Heavy metals (e.g., lead, copper, cadmium) also become more soluble, and therefore more toxic to aquatic species, as pH falls[6].

Variations in pH can be attributed to human influences (i.e., point and non-point source pollution) and natural causes. Photosynthesis, for example, generally raises pH during the summer growing season while plant respiration and decomposition, which predominantly occurs in winter months, lowers pH (Golder Associates 2001).

Climate variability and change may affect pH levels may change as a result of increased precipitation and associated stormwater runoff. pH levels may also be

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[4] http://wow.nrri.umn.edu/wow/under/glossary.html#D

[5] http://www.calfed.water.ca.gov/programs/cmarp/old%20files/ch5c.html

[6] http://wow.nrri.umn.edu/wow/under/parameters/ph.html

affected by changes in plant activity resulting from warmer temperatures and/or variation in precipitation.

3.5 FECAL COLIFORM

Coliform and fecal coliform are viruses indicating the presence of feces in water. Fecal coliform is one of three most common causes for surface water quality problems in Washington State (with temperature and pH) (Beckett 2000). Fecal coliform enters surface water bodies primarily through stormwater runoff and failing septic systems. Potential sources of fecal coliform in groundwater include failing septic systems, broken well casings (potentially allowing fecal-contaminated surface water to mix with groundwater), and sewage sludge application.

Climate variability and change may increase fecal coliform levels through increased precipitation and stormwater runoff, particularly in agricultural areas. Lower summer flows may also concentrate fecal coliform levels, creating a higher health hazard for people exposed to untreated water (e.g., recreationalists) and requiring additional treatment. Additional best management practices and/or engineering controls may be required to manage fecal coliform levels.

3.6 TOTAL SUSPENDED SOLIDS (TSS) AND TURBIDITY

Measurements for total suspended solids and turbidity relate to the presence of suspended materials in water and overall clarity. Total suspended solids (TSS) measures the total amount of organic and inorganic particles suspended in the water. Turbidity measures the ability of light to penetrate the water column. High levels of TSS in the water column will scatter light, reducing the amount of light reaching aquatic communities at stream bottom. Therefore, water bodies with high TSS levels will generally have high turbidity levels as well. Sources of TSS and turbidity include shoreline and stream bank erosion, stormwater runoff, dredging operations, agricultural operations, changes in flow rate (including floods), channelization, and landslides[7].

TSS and turbidity are important water quality parameters given their effect on water quality, water treatment costs, and habitat conditions. Particulates contributing to turbidity provide attachment sites for many heavy metals (e.g., cadmium, mercury, lead) and toxic organic pollutants (e.g., PCBs, PAHs, pesticides)[8]. Disturbances that move particulates through the water supply may transfer water pollution problems downstream. Water supply disinfection costs are affected by treatment standards requiring virtual elimination of turbidity for proper disinfection. Water supplies with higher turbidity levels, therefore, may be more costly to treat.

The effects of TSS and turbidity on salmonids and other aquatic species are also a concern. High TSS and turbidity levels can:

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[7] http://wow.nrri.umn.edu/wow/under/parameters/turbidity.html

[8] PCB = Polychlorinated biphenyls, PAH = Polycyclic aromatic hydrocarbons (ibid)

- clog gravel bed spaces necessary for salmonid spawning and rearing;
- suffocate incubating salmon egg nests laid in gravel beds;
- interfere with salmon feeding habits;
- damage sensitive gill structures in fish and invertebrates[9]; and
- reduce aquatic plant growth, affecting survival of organisms dependent on aquatic plants for food and cover[10].

TSS and turbidity levels may be affected by the higher *and* lower flows associated with climate variability and climate impacts. Increased precipitation and related streamflows may increase TSS and turbidity inputs from stormwater runoff, stream bank erosion, landslides, and flooding. Conversely, lower flows may contribute to settling out of particulates onto gravel beds and salmon nests, smothering incubating eggs.

[9] http://wow.nrri.umn.edu/wow/under/parameters/turbidity.html

[10] ibid

4 Coastal Impacts Associated with Climate Variability and Change

Many Washington State watersheds have coastal areas that may be affected by climate variability and change. Threats to coastal ecosystems from climate variability and change include sea level rise, coastal erosion, coastal flooding, bluff landsliding, coastal inundation, and water quality degradation.

4.1 SEA LEVEL RISE (PUGET SOUND REGION)

Changes in sea level can result from short-term processes such as El Niño events (which increase relative sea level), along-shore wind stress, storm events, rainfall and river runoff, and long shore propagation. Long-term processes such as tectonic movements, glacial rebound of land masses from the last glacial age, and climate change also affect sea level. Observed global sea level rise during the 20th century was in the range of 0.04 to 0.1 inches/year (4-10 inches per 100 years).

Sea level is projected to increase globally by 4.3 inches to 2.5 feet by 2100 (from 1990 levels) as a result of climate change. Contributions to sea level rise through the 21st century include thermal expansion of the ocean (warm water expands) and glacial melt; contributions from the Greenland ice sheet and Antarctica are relatively small in the 21st century (IPCC 2001). Extreme high water level events are expected to increase with sea level rise and changes in storm surges, which could become more frequent or severe. This increase may be off-set to some degree within the Puget Sound given the Sound's inland location, which tends to temper storms and wave energy in comparison with the more exposed Pacific Ocean coast (Canning and Mote 2003). *There is no estimate currently for projected sea level rise specific to the Puget Sound region for the 21st century.*

Tectonic movements – i.e., the lifting and sinking ("subducting") of land masses as a result of movements in the earth's crust – have a major influence on sea level in the Puget Sound. In the PNW, major tectonic movement is occurring with the subduction of the offshore San Juan de Fuca Plate under the North American Plate (ibid). Tectonic plate movement may reduce (if there is lifting) or enhance (if there is subducting) the effects of sea level rise. As a result, changes in sea level will vary throughout the Puget Sound depending on the rate of change in land elevation from tectonic processes *and* the rate of change in sea level from short-term and long-term processes. Sea level changes, therefore, are referred to as "relative" changes.

Central and south Puget Sound are experiencing relative increases in sea level on the order of .04 to .08 inches/year (4-8 inches per 100 years) as the subduction of the Juan de Fuca plate under the North American plate lifts land masses in the central and south Puget Sound area. In the Olympic Peninsula, the same uplifting process has actually resulted in a relative *decrease* in sea level as the rate of uplifting - as much as 0.13 inches per year, or 13 inches per 100 years – exceeds the rate of sea level rise (Miles 1997). Land subsidence in north Puget Sound and eastern Strait of Juan de Fuca is zero. Thus, net local sea level rise in north Puget Sound is close to the observed global average for the 20th century but up to double the global average in south Puget Sound (Canning and Mote 2003).

The City of Olympia undertook a study in 1993 to assess its vulnerability to sea level rise in the year 2100 as a result of global climate change. The most significant impact found was an increase in the potential for more frequent and more severe flooding in the downtown area. Additional potential impacts included:

- increased infiltration and hydraulic surcharging of the sewage system,
- increase risk of seismic damage from earthquakes,
- potential salt water seepage into drinking water supplies,
- increased risk of contamination from underground storage tanks and pipes as a result of the increased potential for corrosion of these units, and an
- increased risk of erosion, landslides, and habitat loss along the Budd Inlet shoreline.

The study assumed a one foot increase in relative sea level by 2100 (Miles 1997).

4.2 COASTAL EROSION (SHORELINE RETREAT)

Research indicates that El Niño events contribute to short-term increases in winter sea level and frequency of extreme waves from the south-southwest along the ocean coast, increasing erosion on coastal beaches. Recent work suggests that larger than average waves also tend to be generated during strong La Niña events (Canning and Mote 2003). Climate change may contribute to increased coastal erosion through long-term increases in sea level and storm surge reach.

4.3 COASTAL FLOODING

Coastal flooding is most damaging when high river flows reach the coast during high tide. Coastal flooding, therefore, tends to be an episodic, localized problem (ibid). The potential for coastal flooding increases during La Niñas and cool phase PDOs given the potential for higher winter streamflows from increased winter precipitation. The potential for coastal flooding also increases during El Niño events, which favor higher sea levels. Climate change may increase the potential for coastal flooding given the projected increases in sea level, winter precipitation, and streamflows. Higher sea levels also provide a higher base for storm surges and therefore coastal flooding (ibid). It is not known, however, how storm surges may change as a result of climate change (ibid).

4.4 BLUFF LANDSLIDING

The potential for bluff landslides depends on many factors, including the timing and intensity of rainfall, local geological characteristics, the recent history of landslides, and the degree and nature of site modification during land development (i.e., vegetation removal, earth moving to reshape the site, storm water management practices, and long-term vegetation management practices) (ibid). La Niña events tend to increase winter rainfall, which in turn increases soil saturation and therefore landsliding. Large numbers of landslides in the Seattle area, for example, occurred during the winters of 1933-34, 1985-86, 1996-97, and 1998-99. All were La Niña winters, and all but 1985-86 were exceptionally wet winters (ibid). There

remains, however, no systematic and comprehensive regional review or analysis of landslide records in correlation with with ENSO events. Climate change may increase the risk of landslides due to the projected increase in winter precipitation.

4.5 COASTAL INUNDATION

Coastal inundation refers to submersion of low-lying land under water as a result of rising sea levels. Coastal inundation, unlike flooding, is a gradual process evolving on decadal time scales in response global factors such as sea level rise and local factors such as land subsidence (ibid). There are no localities known to be undergoing inundation in the PNW at present, but areas now subject to coastal flooding are likely candidates for future inundation. Climate change may increase the potential for coastal inundation as a result of sea level rise.

4.6 WATER QUALITY DEGRADATION

Climate variability and change may affect water quality in coastal and estuarine water bodies, including coastal aquifers, as a result of changes in the timing and volume of freshwater inputs from rivers and streams and increased ambient air and water temperatures. Affected water quality variables may include temperature, salinity, light penetration, dissolved oxygen levels, and nutrient concentrations as well as concentrations of toxic substances, metals, and other human-induced substances that reach coastal waters. Changes in saltwater density may also be affected. All of these variables can affect the marine food web directly through an organism's temperature, salinity, and light tolerances, or indirectly through changes in food and habitat availability and/or quality (ibid).

While additional research on the impacts of climate variability and change on PNW coastal and estuarine water quality is needed, preliminary research indicates that water quality is influenced by patterns of climate variability (ibid). River runoff, wind-forced advection and upwelling, percent cloud cover, air temperature, and precipitation, all of which are all related to climate variation, must all be considered when evaluating ENSO effects on water quality in a particular area.

4.7 LOSS OF WETLANDS HABITAT

Climate variability and change may contribute to a loss of coastal wetland habitat through increased erosion, inundation, filling, and/or general degradation of wetland habitat. These losses are accelerated when human barriers (i.e., rip-rap, storm surge walls) and natural barriers (i.e., bluffs) limit the ability of wetlands to move inland in response to rising sea levels and changing wave activity.

4.8 INVASION OF EXOTIC SPECIES

Climate variability and change may contribute to changes in coastal environments that allow for the invasion of exotic species such as Cordgrass (*Spartina* spp) or the European Green Crab (*Carcinus maenas*). Research by Field (1997) and others on the spread of Cordgrass in Willapa Bay during the 1980s suggests that the warmer conditions associated with the climate of the 1980s may have lead to an

unprecedented increase in seed viability, contributing to an estimated quadrupling of Cordgrass distribution during the 1980s (ibid). Invasive species may permanently alter estuary habitats as well as threaten valuable commercial and recreational species, including Dungeness Crabs and oysters (ibid).

5 Integrating Climate Variability and Change into Watershed Planning

The Watershed Planning Program provides an important opportunity to begin assessing and addressing the potential impacts of climate variability and change on PNW water resources at a watershed scale. The long-term perspective required by the program, the number of planning issues potentially affected by climate variability and change (Figure 8), and the potential for binding agreements on water supplies, infrastructure, and instream flow targets all point to the importance of integrating climate impacts into these planning efforts sooner rather than later.

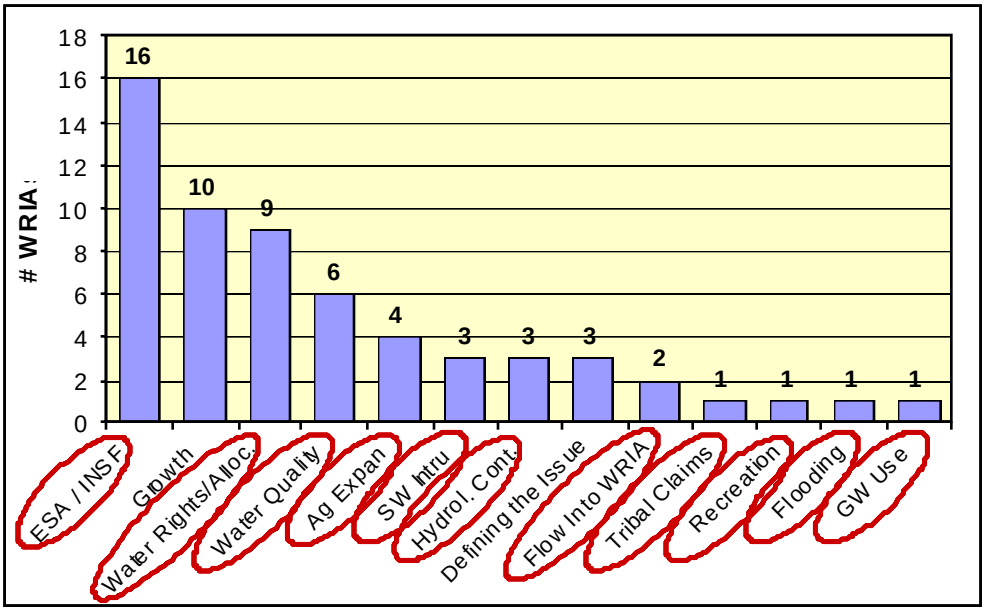

Figure 8: Major water resource planning challenges identified by Washington State watershed planning Leads. Circles indicate those planning challenges which are likely to be affected directly or indirectly by climate change. Major management challenges include Endnagered Species Act (ESA) requirements and related instream flow requirements for salmonids (16 WRIAs), meeting future growth (10 WRIAs), water rights availability and allocation (9 WRIAs), water quality (6 WRIAs), meeting agriculture demands (4 WRIAs), salt water intrusion (3 WRIAs), determining hydrologic continuity between surface water and groundwater systems (3 WRIAs), management of flows originating outside the WRIA (2 WRIAs), tribal claims on water resources (1 WRIA), flooding (1 WRIA), recreation (1 WRIA), and groundwater use (1 WRIA). Simply defining the major challenge is a major challenge in three WRIAs. The challenges were identified through a survey of eleven Department of Ecology Watershed Planning Leads in 2002 (Whitely Binder 2002).

Many water suppliers are beginning to actively incorporate information on climate variability and change into water supply planning and operations. In the Puget Sound region, for example, Seattle Public Utilities regularly incorporates ENSO forecasts into seasonal reservoir management decisions (Mote et al. 1999). The City of Portland, Oregon, recently commissioned a detailed numerical analysis on the

impacts of climate change and population growth on future water supply and demand (Palmer and Hahn 2002). The study found that by 2050, climate change impacts on Portland's water supply system would be, on average, 50% of the total impact expected from population growth in that same period. A similar study is underway with SPU. The results of these studies will be used by Portland and SPU to guide long-range planning decisions.

The ultimate objective of integrating climate impacts into watershed planning processes is building adaptive capacity to efficiently manage these impacts as they occur. This will entail developing (or modifying) policies, practices, and procedures to provide the flexibility necessary to adjust to short-term and long-term changes in climate. Building adaptive capacity may also involve constructing new infrastructure designed to mitigate projected impacts. In all cases, building adaptive capacity to climate variability and change is expected evolve over time. Watershed planners should be open to regular re-evaluation of policies and practices that may conflict with known and projected impacts of climate variability and change.

5.1 APPROACHES TO INTEGRATION

Integrating information on climate change impacts is in many ways a function of risk-management. How well, for example, does the watershed currently respond to hydrologic stresses (e.g., summer drought, winter flooding)? How might this response change given the added stresses of population growth *and* climate change? What new risks may evolve within the watershed as a result of climate change? Taking these and other questions into consideration, what is the risk tolerance within the watershed for the impacts of climate variability and change? If the risk tolerance is low, proactive consideration of these impacts is warranted.

An important first step to integrating climate information into watershed planning is developing local understanding of the impacts of climate variability and change on the PNW. This includes familiarizing local planners, decision makers, and the general public with the known and projected impacts, and working regular discussion of these impacts into planning processes and documentation.

Identifying watershed management goals are also important for building adaptive capacity. Watershed managers throughout the Pacific Northwest are regularly asked to balance competing water resource management objectives, particularly during the dry summer months. Population growth and climate change will increase the cost and frequency of these tradeoffs over the next several decades. As watershed managers look to future needs, what standards will define success? Does successful adaptation mean, for example, maintenance of the status quo with respect to water allocation? Does it mean improved fish flows with no loss to irrigated agriculture or municipal uses? This type of goal setting is typical in traditional watershed planning processes. Recognizing the impacts of climate variability and change in setting these goals may increase the likelihood of successfully meeting the goals.

Many types of watershed-based planning activities provide avenues for integrating climate impacts and building adaptive capacity. This includes not only the

Watershed Planning Program but also other planning activities that may be affected by the scope of a watershed plan, including:

- salmon recovery planning (e.g., Washington's Salmon Recovery Act [ESHB 2496])
- water supply planning
- local land use planning
- flood control planning
- forest management plans, and
- water quality management.

A key question to consider in any planning exercise is whether the decisions being made are robust given what is known (and not known) about climate variability and change in the PNW. Do decisions involving traditional assumptions about the quantity and timing of streamflows, for example, still meet their intended objective if conditions fall outside the assumed boundaries and/or become more variable? Decisions taking these possibilities into account may improve a watershed's ability to meet management objectives even as climate variability, climate change, and population growth affect resources.

More detailed evaluation of climate impacts may also be preferred or even necessary. Detailed climate impacts assessments can serve as useful tools for evaluating policy and infrastructure choices. The previously cited Portland climate change study, for example, included an examination of scenarios for increasing water supplies to meet the deficits projected by the 2020s and 2040s as a result of regional growth and climate change. Two supply scenarios were evaluated: constructing a third reservoir within the Bull Run watershed and increasing groundwater production from the Columbia South Shore Wellfield. The detailed analysis proved valuable in assessing which supply-side options the city could take to address the projected 8 billion gallon 2020 deficit (9.6 billion gallons by 2040). The lead time provided by this type of analysis is particularly important given the time frame required for developing new sources of water and/or instituting conservation programs. Detailed analyses can be conducted in partnership with local universities or contracted with consulting agencies.

5.2 Options for Building Adaptive Capacity

Options for adapting to climate impacts are varied and familiar. Many of the options watershed planners will consider for addressing future watershed needs can also serve as options for adapting to climate variability and change. *The key, as noted previously, is considering the additional impacts of climate and making sure that the decisions made are robust enough to address climate impacts.*

Table 3 lists many water supply management strategies that may be useful in developing robust policy responses to climate impacts. Many of these strategies can be implemented within a watershed; others may require changes in state policies. More information on these options is available in Hamlet et al. 2001b.

5.3 CONCLUDING COMMENTS

Recognizing the influence of climate variability and change on water supplies provides watershed managers the opportunity to begin developing watershed management plans and policies capable of efficiently adjusting with short-term and long-term changes in water supplies. A key question to consider while choosing watershed management strategies is how robust the management choices are. Will the choice(s) still meet the intended objective(s) if the baseline assumptions about watershed conditions vary in accordance with observed impacts from climate variability and/or change in accordance with climate change projections? Developing a robust system will take time to evolve. Taking the steps now to begin addressing climate impacts lays an important foundation for building a more adaptive and flexible watershed management structure.

Table 3: Options for Building Adaptive Capacity to Climate Variability and Change (Hamlet et al. 2001b)

Options for Building Adaptive Capacity to Climate Variability and Change	
Conventional Changes in Infrastructure - Increase Usable Storage - Diversify Sources of Water Supply - Connect Regional Water Systems *Incorporating Improvements in Hydrologic Forecasting, Information Systems, and Associated Water Management Practices* - Improved Streamflow Forecasts for Water Management - Climate Information and Monitoring	*Conservation and Demand Management* *Technical Innovations* - High Efficiency Delivery Systems for Irrigated Agriculture - Advanced Waste Water Treatment - Reverse Osmosis *Water Banks and Water Markets*

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Appendix 2

Appendix 3: Sequim Bay Section of the Draft WRIA 18 Watershed Plan

Sequim Bay Section of the Draft WRIA 18 Watershed Plan

The following information is excerpted from Chapter 3.15 of the DRAFT WRIA 18 Watershed Plan, and provides recommendations that cover the Sequim Bay watershed. The DRAFT WRIA 18 Watershed Plan also includes planning-area-wide recommendations that would pertain to the Sequim Bay watershed; the interested reader is referred to the DRAFT WRIA 18 Watershed Plan for more information. At the conclusion of this section is a table, also from the DRAFT WRIA 18 Watershed Plan, that summarizes instream flow recommendations for the Sequim Bay watershed.

3.15 SEQUIM BAY AND DRAINAGES RECOMMENDATIONS

3.15.1 Johnson Creek (WRIA# 17-0301)

Issue: Johnson Creek currently experiences elevated fecal coliform levels, resulting in shellfish closure. The system also has a number of culverted channel sites, contributing to erosion and possible culvert blockages.

Existing Condition and Current Actions

The Johnson Creek watershed is the third largest Sequim Bay subwatershed and has been significantly altered from its historic condition. Land use practices, residential and other development, integration into the regional irrigation system, and channelization and armoring of the stream have resulted in significant sediment, fecal coliform, channel instability, riparian and floodplain degradation, and other impacts. Since 1994, it has been on the 303(d) list for elevated fecal coliform, which is likely to derive from domestic and wild animals, irrigation-borne, and septic sources.

Desired Conditions and Outcomes

- Creek meets water quality standards
- Shellfish harvest area upgraded from Prohibited to Approved
- Stabilized banks; planted riparian corridor

Recommendations

A. Water Quality:

1. Eliminate livestock access; install farm BMPs, cost share with property owners.
2. Repair/replace septics; implement septic Operation and Maintenance program.

3. Ensure irrigation tailwater and irrigation infrastructure does not degrade creek water quality.
4. Manage stormwater to avoid water quality and quantity impacts to aquatic life in the watershed (see Stormwater Recommendations, Section 3.5).

B. Habitat:

1. Evaluate, prioritize, and treat erosion problems in the watershed.
2. Re-establish healthy, native riparian vegetation.
3. Inventory culverts; maintain, and replace where needed to provide for fish passage or to resolve sediment and/or flow problems.
4. Establish a riparian zone in the lower watershed adjacent to the trailer court.[1]

3.15.2 Sequim Bay State Park Creek

Issues: The Sequim Bay State Park septic system is seasonally overloaded and may fail, creating a potential public health problem.

Existing Conditions and Current Actions

During the recreational season the Sequim Bay State Park septic system is overloaded and at risk of failure. The Park has received permission for an exception under GMA to connect to the City of Sequim sewage treatment system. DOH monitors marine water and no current water quality standards are exceeded at the Park. The creek at the Park is not considered an anadromous stream, however there is no data on this creek's biology or water quality. Shellfish harvest is closed for two weeks during the late summer early fall when many boats use the park.

Desired Conditions and Outcomes

- Creek meets water quality standards
- Shellfish harvest area remains open, with no further degradation of shellfish harvest

Recommendations

A. Water Quality:

1. Fund a permanent solution to sewage disposal at Park to enable connection of the Park to the City of Sequim sewage system, subject to GMA provisions.

[1] From WRIA 17 Limiting Factors Analysis

B. Habitat:

No new stream-specific recommendations were developed.

3.15.3 Dean Creek (WRIA# 17-0293)

Issue: Dean Creek is in a dysfunctional condition, causing severe flooding. There is a likelihood of water quality violations due to current and historic land use activities. Alterations to the channel in several reaches, conducted as flooding remedies, have destroyed instream fish habitat.

Existing Condition and Current Actions

Dean Creek is a small, occasionally dry stream that enters South Sequim Bay in its southwest corner. The creek, especially in the lower reaches, has been culverted in various locations. It also experiences episodes of significant sedimentation, mostly arising from the lingering impacts of past road and land clearing activities. The sediment aggradation causes the stream to go subsurface in some places—a characteristic that may not be consistent with its historic, natural condition. Dean Creek is being incorporated into the overall JimmyComeLately-Lower Sequim Bay Estuary Restoration Project, at least as far upstream as the Hwy. 101 crossing.

Desired Conditions and Outcome

- Functional creek/estuary
- High quality fish habitat
- Meets or exceeds water quality standards that support its beneficial uses

Recommendations

A. Water Quality:

1. Implement JimmyComeLately--Lower Sequim Bay Estuary Restoration Plan
2. Manage stormwater to avoid water quality and quantity impacts to aquatic life in the watershed
3. Manage forestry/DNR property to ensure no water quality problems in the creek

B. Habitat:

1. Implement the JimmyComeLately—Lower Sequim Bay Estuary Restoration Plan (see Section 3.15.4 (B)).
2. Monitor fish presence; submit stream type upgrade? (LFA)
3. Replace culvert at Old Blyn Highway (LFA).

4. Submit stream type upgrades with appropriate agencies to reflect fish passage—at least as far upstream as the BPA power lines.[2]

3.15.4 JimmyComeLately Creek (WRIA# 17-0285)

Issue: JimmyComeLately Creek and its estuary have been significantly altered over time, causing habitat destruction, water quality problems and severe flooding.

Existing Condition and Current Actions

JimmyComeLately Creek, though heavily altered in its past, is undergoing an extensive restoration that is projected to be completed by 2006 (though maturation of revegetated areas and return of anadromous stocks will evolve for years thereafter). This project will eliminate and/or vastly improve many of the current problematic conditions.

Desired Conditions and Outcomes

- Creek meets Water Quality standards
- Shellfish harvest area remains Approved
- Salt water intrusion prevented
- Restored creek and estuary function
- Restored summer chum
- High quality habitat is widely available for fish and wildlife
- An intact, functional wildlife corridor is maintained

Recommendations

A. Water Quality:

1. Implement JimmyComeLately—Lower Sequim Bay Estuary Restoration Plan.
2. Manage stormwater to avoid water quality and quantity impacts to aquatic life in the watershed.
3. Eliminate livestock access; install farm BMPs, cost share with property owners, (LFA).
4. Repair/replace septics; implement O&M.
5. Seek alternative techniques for sewage treatment and disposal.
6. For saltwater intrusion prevention remedies see groundwater recommendations, Section 3.1.4 (B).

[2] From WRIA 17 Limiting Factors Analysis

B. Habitat:

1. Implement JimmyComeLately—Lower Sequim Bay Estuary Restoration Plan[3]
    a. Remove pilings and contaminated sediment from the estuary
    b. Remove log yard fill
    c. Remove log yard road
    d. Turn the abandoned trailer park and infrastructure into a salt marsh
    e. Use WDOT mitigation funds to construct tidal channels
    f. Remove the county road (Old Blyn Highway)
    g. Move the creek channel to the west to its historic location, construct new highway bridge and plant the riparian zone
    h. Remove the delta cone accretion of the old channel to regain intertidal habitat
    i. Remove trestle over the tributary that carries casino stormwater and replace with a pedestrian bridge (the trestle still leaks creosote)
    j. Underplant riparian zone (below the cascade) with conifer
    k. Conduct culvert assessment
    l. Install livestock exclusion fencing, coupled with riparian planting, in the upper watershed
2. Continue and fund broodstock program (DQ)
3. Control erosion in watershed

3.15.5 No Name Creek (enters Bay at Tribal Administration Building)

Issues: Stormwater periodically creates water quality and flooding concerns. Excessive sediment is found in the system due to current and historic land use practices.

Existing Conditions and Current Actions

No Name Creek is a small creek originating in the hills above Chicken Coop Creek Road. It runs through a culvert beneath Highway 101 and Old Blyn Highway and is channelized along its drainage route to Sequim Bay. The creek receives untreated storm water from roads and parking areas. Its headwaters were clearcut

[3] The following items of the restoration plan previously appeared as WRIA 17 LFA recommendations.

in the 1990s and, since that time, sediment has begun to build up near its mouth. In its current condition, this creek does not likely support fish species.

Desired Conditions and Outcomes

- Creek meets Water Quality standards
- Sedimentation controlled

Recommendations

A. Water Quality:

1. Control stormwater in watershed
2. Control erosion in watershed

B. Habitat:

1. Improve culverts
2. Control erosion in watershed

3.15.6 Chicken Coop Creek WRIA# 17-0278

Issue: Chicken Coop Creek experiences excess sedimentation and sporadic water quality violations. There are several fish passage blockages as well as degraded fish and wildlife habitat.

Existing Condition and Current Actions

Chicken Coop Creek is the second largest watershed in the Sequim Bay basin. It suffers from the effects of numerous culverts throughout the watershed and has experienced various episodes of excessive sediment. These sediments may contribute to the occasionally intermittent presence of surface flow—a condition that has been identified as potentially the most significant limiting factor for restoration of anadromous stocks.

Desired Conditions and Outcomes

- Creek meets water quality standards
- Shellfish harvest area continues to be classified as Approved
- Healthy fish and wildlife habitat; sediment controlled

Recommendations

A. Water Quality:

1. Control sedimentation in watershed

2. Livestock exclusion fencing, BMPs, continue costshare programs, support Conservation District
3. Manage stormwater to avoid water quality and quantity impacts to aquatic life in the watershed
4. Repair/replace septic systems, implement O&M

B. Habitat:

1. Repair culverts under E. Sequim Bay Rd, Old Blyn Highway, Highway 101, Chicken Coop Road (LFA)
2. Add LWD (LFA)
3. Plant riparian zone with native species, in order to provide cover and future large woody debris recruitment (LFA)

Limiting Factors Analysis (LFA) Recommendations

- Repair the culverts under East Sequim Bay Road, Old Blyn Highway, US 101, and Chicken Coop Road
- Add large woody debris
- Plant a riparian zone

Note: The LFA recommendations are provided here for information. LFA recommendations are not adopted as such in the watershed plan, though it is recognized that updates are needed in some area. Some conflicts may exist between the LFA and the watershed plan; where conflicts exist, these would need to be reconciled by the involved jurisdictions on a case-by-case basis.

3.15.7 Sequim Bay Estuarine Wetlands

Washington Harbor

Issues: This estuarine wetland, at the mouth of Bell Creek, is classified Prohibited for shellfish harvest. The Sequim Sewage Treatment Plant outfall pipe culvert blocks habitat and the area has a history of *Spartina* invasion.

Existing Conditions and Current Actions

Washington Harbor is the tidal estuary at the mouth of Bell Creek. It is well protected by Gibson Spit on the east. It is internationally recognized as an important estuary for migratory waterfowl and other wildlife. An outfall pipe from the City of Sequim Sewage Treatment Plant (SSTP) blocks the northern portion of the estuary, with two culverts providing minimal tidal exchange. The City of Sequim upgraded its sewage treatment plant to produce Class-A water and is working toward full wastewater reuse. The owner of the estuary has removed some dikes along the estuary's western edge to improve estuarine habitat.

Desired Conditions and Outcomes

- Shellfish harvest classification upgraded to Conditional or Approved
- Habitat in northern portion of estuary restored to support full range of naturally-occurring shellfish, forage fish, other invertebrates, estuarine vegetation, and associated terrestrial wildlife

Recommendations

A. Water Quality:

1. Continue to seek ways to upgrade shellfish harvest classification

B. Habitat:

1. Restore tidal exchange between the northern and southern portions of the estuary currently constricted by the two culverts under the Sequim Sewage Treatment Plant outfall.
2. Regularly monitor northern part of estuary to ensure *Spartina* has been fully removed

Wayne Wetland (on West Sequim Bay Road)

Issues: Upland development poses a potential threat to the functioning of this wetland. It is also impacted by the culvert under W. Sequim Bay Road, which has altered the flow regime of the wetland.

Existing Conditions and Current Actions

This wetland is undeveloped on three sides, but it is blocked from its connection to Sequim Bay by West Sequim Bay Road. One narrow culvert allows tidal exchange. A residential development is being proposed within the subbasin.

Desired Conditions and Outcomes

- Water quality is maintained throughout any watershed development
- Healthy fish and wildlife habitat

Recommendations

A. Water Quality:

1. Ensure upland development does not impact wetland
2. Control stormwater

B. Habitat:

1. Improve culvert under W. Sequim Bay Road

Blyn Wetlands (aggregate mouth of Dean, JCL, no-name and Chicken Coop creeks)

Issues: Sedimentation from existing land uses in the area, as well as the threat posed by further upland development pose current and future water quality impacts as well as causing dysfunctional fish and wildlife habitat.

Existing Conditions and Current Actions

This estuarine system has hydrology input from Dean, JimmyComeLately, No-Name and Chicken Coop creeks, along with several storm water drainages. It is internationally recognized as an important area for migratory waterfowl and shorebirds, and it provides habitat for mammals, juvenile salmon, shellfish and invertebrates. It is severely impacted by human-made structures, which are slated for removal as part of a large-scale restoration project on JimmyComeLately Creek and its estuary. These structures include roads, creosote pilings and trestles. The uplands are being zoned for rural center and are gradually being developed for administration and commercial/recreational uses.

Desired Conditions and Outcomes

- Shellfish harvest areas remain Approved
- Functional and healthy fish and wildlife habitat

Recommendations

A. Water Quality:

1. Ensure upland development does not impact wetlands

B. Habitat:

1. Implement JimmyComeLately—Lower Sequim Bay Restoration Project

Paradise Cove

Issues: This wetland has been compromised by past land use practices, causing the loss of extent and quality of valuable fish and wildlife habitat.

Existing Conditions and Current Actions

Paradise Cove is an estuary in the northeastern corner of Sequim Bay and is protected by Travis Spit and a steep cobble beach. There are productive clam beds inside the cove. Currently, the cove is not heavily developed; there are two docks and several houses along a 15-foot bluff above the beach. There are indications of excessive algae in portions of the cove, implying that excess nutrients enter the water.

Desired Conditions and Outcomes

- Shellfish harvest area is not diminished and remains open
- Functional and healthy fish and wildlife habitat

Recommendations

A. Water Quality:

1. Ensure upland development does not impact wetland

B. Habitat:

1. Ensure upland development does not impact wetland

3.15.8 Sequim Bay Marine Shoreline and Waters

Issues: Shellfish harvest areas along much of the Sequim Bay shoreline are threatened from upland development and land use practices and they experience occasional water quality violations. Various shoreline encroachments (docks, etc.), bulkheading, and vegetation removal have caused significant loss of habitat.

Existing Conditions and Current Actions

This is a newly-identified focus, not previously treated in the LFA or other studies. No specific information is available for these particular shoreline areas.

Desired Conditions and Outcomes

- Marine waters meet Clean Water Act and shellfish harvest standards.
- Healthy fish and wildlife habitat, including forage fish spawning beaches, eelgrass, and shellfish beds.

Recommendations

A. Water Quality:

1. Repair/replace septics; seek new solutions for sewage disposal, implement O&M.
2. Manage stormwater to avoid water quality and quantity impacts to aquatic life in the watershed.
3. Prevent animal waste (farm and pet) from entering marine waters.
4. Seek remedies to upgrade all shellfish harvest areas currently classified “Conditional” or “Prohibited” to “Approved”.
5. Remove creosote structures; prevent use of creosote for any new development.

6. Manage John Wayne Marina to prevent pollution form boats, pump-out station, septic system and parking lots.
7. Continue to manage City of Sequim Wastewater Treatment and Reclaimed Water plant to prevent water pollution.
8. Inventory shoreline land use and habitat changes.
9. Encourage water reuse and reclamation (see Section 3.1.10).

B. Habitat:

1. Prevent encroachments onto tidelands (docks and floats; fill).
2. Enforce development control to prevent human caused erosion.
3. Remove bulkheads; replace with soft bank armoring.
4. Protect eelgrass beds, forage fish spawning areas, and other high value habitats from encroachments and impacts from development.
5. Continue acquisition and restoration to achieve the goals of the Pacific Coast Joint Venture Strategic Plan (for migratory waterfowl).

Limiting Factors Analysis (LFA) Recommendations

- Remove creosoted pilings and contaminated sediments from barge work
- Remove abandoned log yard fill to restore estuary function of both Dean and JimmyComeLately Creeks
- Remove log yard road
- Reclaimed trailer park could become salt marsh habitat, although there is no evidence of an historic salt marsh
- Reconnect tidal channels of JimmyComeLately Creek
- Remove the county road
- Move JimmyComeLately Creek channel to the west to its historic location
- Remove the delta cone accretion of the old channel (JimmyComeLately) just low enough to be intertidal
- Put in a new bridge with three spans over the newly configured JimmyComeLatelyCreek
- Remove the railroad trestle over the tributary to JimmyComeLately that carries stormwater from the casino and replace the trestle with a walking bridge
- Add sinuosity to Dean Creek below highway 101
- Replace a culvert between two spits that truncates a valuable salt marsh south of Pitship Point with a bridge

Note: The LFA recommendations are provided here for information. LFA recommendations are not adopted as such in the watershed plan, though it is recognized that updates are needed in some area. Some conflicts may exist between the LFA and the watershed plan; where conflicts exist, these would need to be reconciled by the involved jurisdictions on a case-by-case basis.

Table 3.4-1. (Sequim Bay only) Instream Flow Recommendations for WRIA 17 (Sequim Bay) Streams.

Stream	Toe-Width (feet)	Spawning and Rearing flows (cfs)	Instream Flow Recommendations (cfs) (WDOE 1997)											
			J	F	M	A	M	J	J	A	S	O	N	D
Chicken Coop	7.9	Steel rear 3	8	3	3	3	3	3	3	3	3	8	8	8
Dean	10	Coho spawn 11 Steel rear 4	11	7	7	7	4	4	4	4	4	4	11	11
Jimmycomelately	18	Coho spawn 24 Steel spawn 44 Chum spawn 49 Steel rear 10	24	16	44	44	30	30	10	10	24	24	24	24
Johnson	11.3	Coho spawn 13 Steel spawn 26 Chum spawn 27 Steel rear 5	13	8	26	26	17	17	5	5	5	5	13	13

Note: DQ Plan (1994:Figure 6.5) includes additional flow recommendations for Jimmycomelately Creek.